See the possibilities

User's Manual

CM-141MCL/141MCL-RA
CM-141PMCL/141PMCL-RA
CB-141MCL/141MCL-RA
CB-141PMCL/141PMCL-RA

Digital Monochrome / Color
Progressive Scan Camera

Document Version: Ver.1.2
CM/CB-141MCL_Ver.1.2_Feb2010

1001E-1002

Notice

The material contained in this manual consists of information that is proprietary to JAI Ltd., Japan and may only be used by the purchasers of the product. JAI Ltd., Japan makes no warranty for the use of its product and assumes no responsibility for any errors which may appear or for damages resulting from the use of the information contained herein. JAI Ltd., Japan reserves the right to make changes without notice.

Company and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

Warranty

For information about the warranty, please contact your factory representative.

Certifications

CE compliance

As defined by the Directive 2004/108/EC of the European Parliament and of the Council, EMC (Electromagnetic compatibility), JAI Ltd., Japan declares that CM-141MCL, CM-141PMCL,CM-141MCL-RA, CM-141PMCL-RA,CB-141MCL,CB-141PMCL,CB-141MCL-RA and CB-141PMCL-RA comply with the following provisions applying to its standards.
EN 61000-6-3 (Generic emission standard part 1)
EN 61000-6-2 (Generic immunity standard part 1)

FCC

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Warning

Changes or modifications to this unit not expressly approved by the party responsible for FCC compliance could void the user's authority to operate the equipment.

Supplement

The following statement is related to the regulation on " Measures for the Administration of the control of Pollution by Electronic Information Products " , known as " China RoHS ". The table shows contained Hazardous Substances in this camera.

mark shows that the environment-friendly use period of contained Hazardous Substances is 15 years.

重要注意事项

有毒，有害物质或元素名称及含量表

根据中华人民共和国信息产业部『电子信息产品污染控制管理办法』，本产品《 有毒，有害物质或元素名称及含量表 》如下.

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PPB)	多溴二苯醚 (PBDE)
螺丝固定座	×	○	○	○	○	○
.....	.....	.....	.....	.....	.....	.....

○: 表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。
×: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。
（企业可在此处、根据实际情况对上表中打 " × " 的技术原因进行进一步说明。）

环保使用期限

电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染或对基人身、财产造成严重损害的期限。

数字「15」为期限15年。

Supplement

The following statement is related to the regulation on " Measures for the Administration of the control of Pollution by Electronic Information Products " , known as " China RoHS ". The table shows contained Hazardous Substances in this camera.

mark shows that the environment-friendly use period of contained Hazardous Substances is 15 years.

重要注意事项

有毒，有害物质或元素名称及含量表

根据中华人民共和国信息产业部『电子信息产品污染控制管理办法』，本产品《 有毒，有害物质或元素名称及含量表 》如下.

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PPB)	多溴二苯醚 (PBDE)
螺丝固定座	×	○	○	○	○	○
光学滤色镜	×	○	×	○	○	○
.....	.....	.....	.....	.....	.....	.....

○: 表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。
×: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。
(企业可在此处、根据实际情况对上表中打 " × " 的技术原因进行进一步说明。)

环保使用期限

电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染或对基人身、财产造成严重损害的期限。

数字「15」为期限15年。

Table of Contents

1. General 4
2. Camera nomenclature 4
3. Main Features 5
4. Locations and Functions 6
4.1. CM-141MCL/CB-141MCL 6
4.2. CM-141PMCL/CB-141PMCL 7
5. Pin Assignment 8
5.1 12-pin Multi-connector (DC-in/GPIO/Iris Video) 8
5.2 Digital Output Connector for Mini CameraLink 8
5.2.1 CM-141MCL/-RA and CB-141MCL/-RA 8
5.2.2 CM-141 PMCL /-RA and CB-141 PMCL/-RA 9
5.3 DIP switch SW600 9
5.4 Input and output circuits 10
5.4.1 Iris video output 10
5.4.2 Trigger input 10
5.4.3 XEEN output 10
5.4.4 Camera Link interface 11
5.4.5 Video Output Bit allocation 12
6. Functions and Operations 13
6.1. Basic functions 13
6.1.1 Vertical Binning (CM-141MCL only) 13
6.1.2 CB-141MCL Bayer mosaic filter 14
6.1.3 Partial Scanning (fixed rate and variable) 14
6.1.4 Electronic Shutter 16
6.1.5 Auto-Iris Lens video output (12-pin Hirose connector) 17
6.1.6 Auto-detect LVAL-sync / async accumulation 17
6.1.7 Rear panel indicator. 18
6.2. Sensor Layout and timing 19
6.2.1 CCD Sensor Layout 19
6.2.2 Horizontal timing 20
6.2.3 Vertical timing 20
6.2.4 Partial Scanning 21
6.2.5 Vertical binning 22
6.3. Operation Modes 23
6.3.1 Continuous operation 23
6.3.2 Edge Pre-select (EPS) Trigger Mode 24
6.3.3 Pulse Width Control (PWC) Trigger Mode 25
6.3.4 Reset Continuous (RCT) trigger mode 27
6.3.5 Smearless EPS Trigger mode 28
6.4. Operation Mode and Functions matrix 29
7. Configuring the Camera 30
7.1 RS-232C control 30
7.2 Setting functions 31
7.2.1 Bit allocation. BA=0, BA=1, BA=2 31
7.2.2 Partial scan. SC=0 through 5. 31
7.2.3 Vertical binning VB=0, VB=1 31
7.2.4 Shutter mode. SM=0 and SM=1 31
7.2.5 Trigger input select. TI=0, TI=1. 31
7.2.6 Trigger polarity. TP=0, TP=1 31
7.2.7 Gain level. GA=-84 through +670 31
7.2.8 Black level. BL=255 through BL=767 31
7.3 Save and Load Functions. 31
7.4 CM-140MCL / CB-140MCL command list 32

8. Camera Control Tool for CM-141 MCL / CB-141 MCL 34
8.1 Camera Control Tool Interface 34
8.1.1 Camera Control Tool Bar 34
8.2 The About Window 34
8.3 Communication Window 35
8.4 Camera Control Window 36
8.5 Using the Camera Control Tool 37
9. External Appearance and Dimensions 38
10. Specifications 42
10.1 Spectral response 42
10.2. Specification table 43
11. Appendix 45
11.1. Precautions 45
11.2. Typical Sensor Characteristics 45
11.3. Caution when mounting a lens on the camera 45
11.4. Caution when mounting the camera 46
11.5. Exportation 46
11.6. References 46
Change History 48
User's Record 49

1. General

This manual covers the digital monochrome progressive scan camera CM-141MCL/141PMCL/141MCL-RA/141PMCL-RA and color progressive scan camera CB-141MCL/141PMCL/141MCL-RA/141PMCL-RA

Hereafter, CM-141MCL/CB-141MCL will represent a whole series except for specific descriptions.

The CM-141MCL and CB-141MCL are JAI C3 Compact series digital cameras utilizing a Mini Camera Link interface. Both standard optical configurations (CM-141MCL/CB-141MCL) and right angle configurations (CM-141MCL-RA/CB-141MCL-RA) are available. Also, versions with Power over Mini Camera Link are available as CM/CB-141PMCL and CM/CB-141PMCL-RA.
The monochrome version CM-141MCL and the color version CB-141MCL provide a frame rate of 30 frames/second at full resolution of 1.45 million pixels. Using vertical binning (CM-141MCL), or partial scan, the camera can achieve faster frame rates.
The 2/3" CCD with square pixels offers a superb image quality. The high-speed shutter function and asynchronous random trigger mode allows the camera to capture high quality images of fast moving objects.

The color version CB-141MCL, based on a CCD sensor with primary RGB Bayer mosaic filter, outputs raw Bayer images.

The camera's internal processing is a 14-bit process. 8-bit, 10-bit or 12-bit output is available to interface with the capture board.

The cameras also provide an Auto iris control video output.

The latest version of this manual can be downloaded from www.jai.com

For camera revision history, please contact your local JAI distributor.

2. Camera nomenclature

The standard camera composition consists of the camera main body and C-mount protection cap.

The camera is available in the following versions:
CM-141MCL/141MCL-RA/141PMCL/141PMCL-RA
Where C stands for "Compact" family, **M** stands for "Monochrome", **14**1 represents the resolution "1.4 million pixels", 14**1** represents a variation with the same resolution , **MCL** stands for "Mini Camera Link" interface and **PMCL** stands for "Power over MCL". **-RA** indicates a version with a Right Angle adaptor

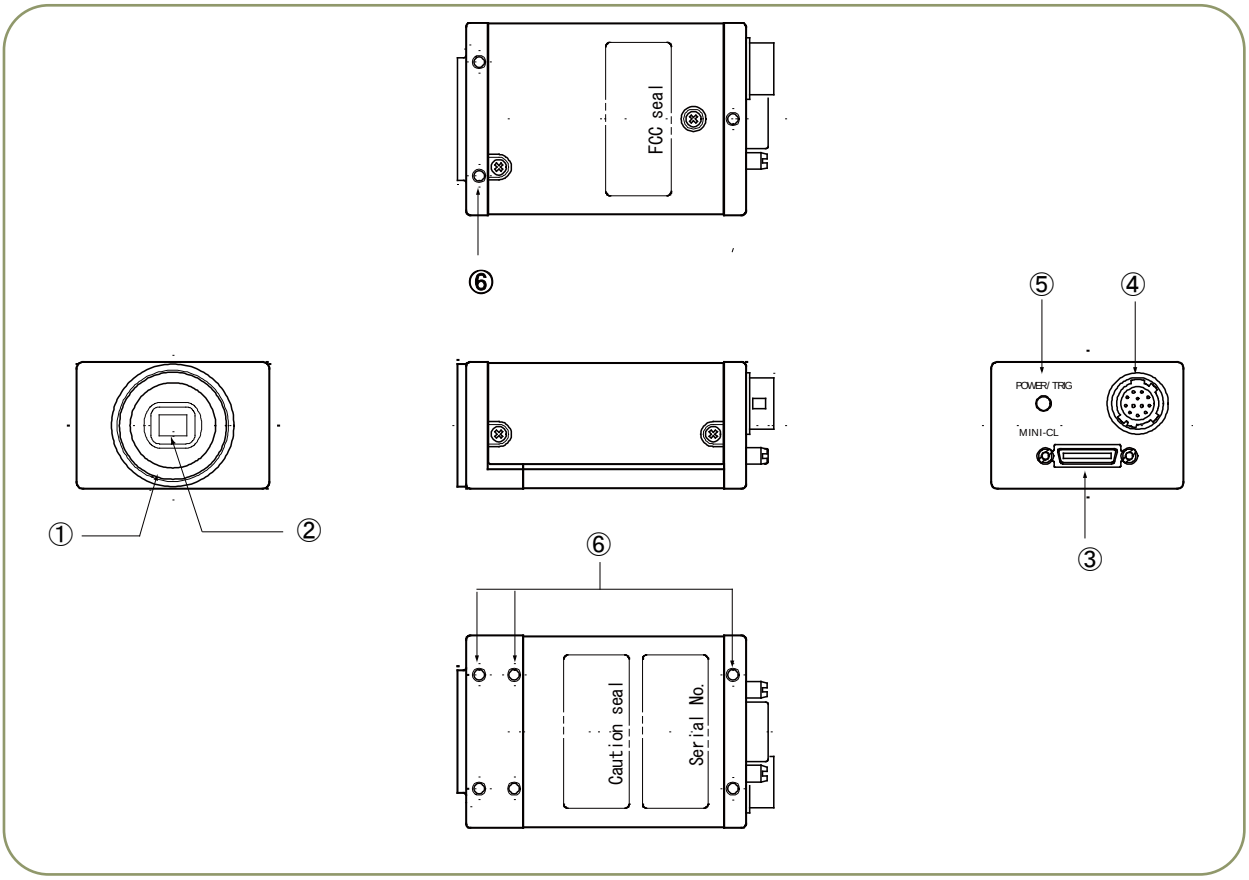
CB-141MCL/141MCL-RA/CB-141PMCL/141PMCL-RA
Where C stands for "Compact" family, **B** stands for "Bayer mosaic color", **14**1 represents the resolution "1.4 million pixels", 14**1** represents a variation with the same resolution **, MCL** stands for "Mini Camera Link" interface and PMCL stands for "Power over MCL". **-RA** indicates a version with a Right Angle adaptor

3. Main Features

- Member of C3 Compact camera series
- Mini Camera Link interface
- 1392 (h) x 1040 (v) 6.45 µm square pixels
- 2/3 inch progressive scan – monochrome and Bayer mosaic color versions
- 14-bit signal processing
- 58 MHz pixel clock
- 30.12 frames/second with full resolution in continuous operation
- 30 frames/second with external trigger and full resolution
- Increased frame rate with vertical binning (CM-141MCL only) and fixed or variable partial scan
- Exposure time from 63µs to 2 sec. using pulse width trigger mode
- Programmable exposure from 63µs to 33 ms in full frame scan
- Preset exposure from OFF to 1/10000
- Fine exposure function can set the exposure with 1 pixel unit up to 1/85149
- Edge pre-select, pulse width control ,reset Continuous trigger and smear less EPS modes
- Manual gain control in the range of -3 dB to 24 dB
- LVAL-synchronous/-asynchronous operation (auto-detect)
- Auto iris lens video output allows a wider range of light
- 12-,10- or 8-bit monochrome or Bayer output
- Standard and right angle optical configuration are available
- Power over Mini Camera Link interface type is available
- Setup by Windows XP/Vista serial communication

4. Locations and Functions

4.1. CM-141MCL/CB-141MCL



1.	Lens mount	C-mount (Note *1)
2.	CCD sensor	2/3 inch CCD sensor
3.	26-pin multi connector	Camera Link interface(Miniature type)(Note*2)
4.	12-pin connector	DC +12V power and trigger input
5.	LED	Indication for power and trigger
6.	Mounting holes	M3 depth 3.5 mm for tripod mount plate(Note*3)

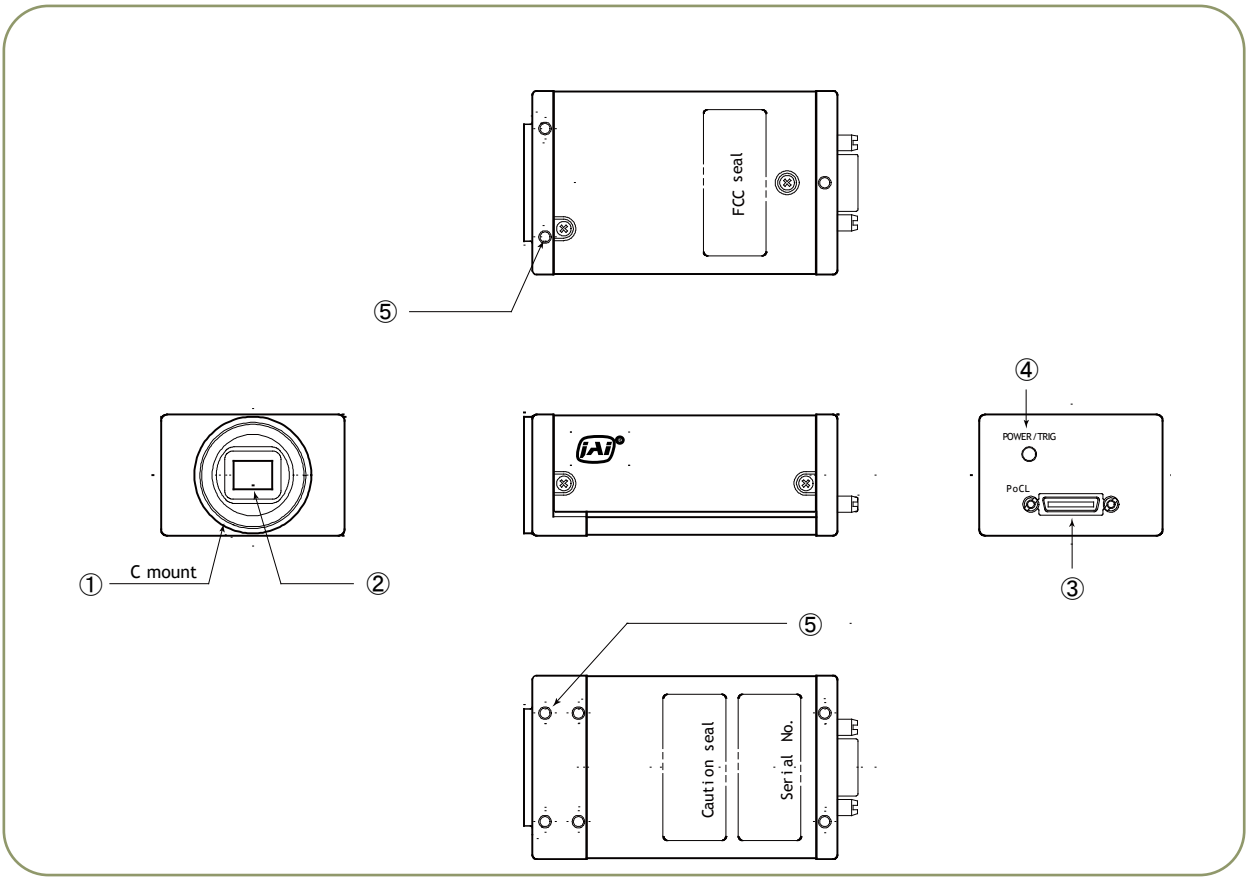
*1) Note: Rear protrusion on C-mount lens must be less than 10.0mm.

*2) Note: When an Mini Camera Link cable is connected to the camera, please do not excessively tighten screws by using a screwdriver. The Camera Link receptacle on the camera might be damaged.
For security, the strength to tighten screws is less than 0.147 Newton meter (Nm).
Tightening by hand is sufficient in order to achieve this.

*3) Note: The tripod adapter plate MP-41 and MP-40 can be used with CM-141MCL/CB-141MCL.
MP-40 uses only two screws instead of 4.

Fig.1. CM/CB-141MCL Locations

4.2. CM-141PMCL/CB-141PMCL



1.	Lens mount	C-mount (Note *1)
2.	CCD sensor	2/3 inch CCD sensor
3.	26-pin multi connector	Camera Link interface(Miniature type)(Note*2)
4.	LED	Indication for power and trigger
5.	Mounting holes	M3 depth 3.5mm for tripod mount plate(Note*3)

*1) Note: Rear protrusion on C-mount lens must be less than 10.0mm.

*2) Note: When an Mini Camera Link cable is connected to the camera, please do not excessively tighten screws by using a screwdriver. The Camera Link receptacle on the camera might be damaged.
For security, the strength to tighten screws is less than 0.147 Newton meter (Nm).
Tightening by hand is sufficient in order to achieve this.

*3) Note: The tripod adapter plate MP-41 and MP-40 can be used with CM-141PMCL/CB-141PMCL. MP-40 uses only two screws instead of 4.

Fig.2. CM/CB-141PMCL Locations

5. Pin Assignment

5.1 12-pin Multi-connector (DC-in/GPIO/Iris Video)

Type: HR10A-10R-12PB (Hirose) male.
(Seen from the rear of camera)

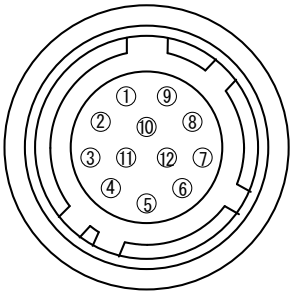


Fig.3. 12-pin connector.

Pin no.	Signal	Remarks
1	GND	
2	+12 V DC input	
3	GND	
4	Iris Video out	Continuous and RCT
5	GND	
6	NC	
7	NC	
8	GND	
9	XEEN output	
10	Trigger input	(Note*1)
11	NC	
12	GND	

*1: Default setting is via Camera Link. This can be selected by command TI. 75ohm termination is available by SW 600.

Note: 12-pin connector is only present on CM-141MCL/-RA and CB-141MCL/-RA.

5.2 Digital Output Connector for Mini Camera Link

Type: 26-pin SDR connector(3M or Honda type)

5.2.1 CM-141MCL/-RA and CB-141MCL/-RA

Fig.4. 26-pin connector

Pin No	I/O	Name	Note
1,13,14,26		GND	DC GND
7(+),20(-)	I/O	RXD	Serial
8(-),21(+)	O	TXD	
10(+),23(-)	I	Reserve	
9(-),22(+)	I	Trigger	CC1 Trigger
6(-),19(+)	O	TxOUT3	CameraLink output
4(-),17(+)	O	TxOUT2	
3(-),16(+)	O	TxOUT1	
2(-),15(+)	O	TxOUT0	
5(-),18(+)	O	TxClk	Clock for CL

5.2.2 CM-141PMCL /-RA and CB-141PMCL/-RA

Fig.5. Mini-CL connector

Pin No	I/O	Name	Note
1	I	DC +12V	
13	I	GND	For # 26 pin
14	I	GND	For # 1 pin
26	I	DC +12V	
7(+),20(-)	I/O	RXD	Serial Com.
8(-),21(+)	O	TXD	
10(+),23(-)	I	Reserve	
9(-),22(+)	I	Trigger	CC1 Ext. Trigger in
6(-),19(+)	O	TxOUT3	Camera Link out
4(-),17(+)	O	TxOUT2	
3(-),16(+)	O	TxOUT1	
2(-),15(+)	O	TxOUT0	
5(-),18(+)	O	TxClk	Clock for CL

Important Note for PMCL version

CM-141 PMCL/-RA and CB-141 PMCL/-RA cameras feature “Safe Power” circuit which is stipulated by the PoCL standard. This circuit is used to verify the presence of camera and PoCL cable before the frame grabber provides power.

5.3 DIP switch SW600

This is for the selection of TTL or 75 ohm termination for trigger input.
Factory default setting is TTL.
When DIP switch SW600 is changed, at first remove the top cover. The factory default is set two switches to OFF position. In order to set 75 ohm, two switches should be changed to ON position.

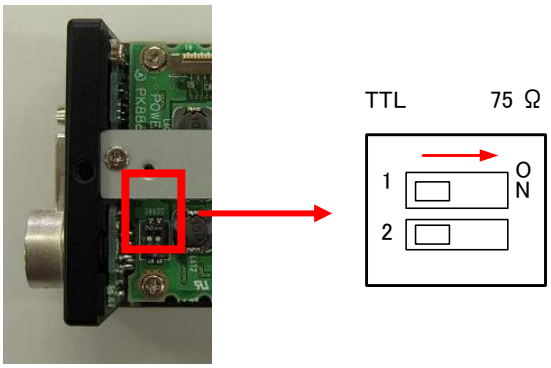


Fig.6. SW-600 DIP switch

5.4 Input and output circuits

In the following schematic diagrams the input and output circuits for video and timing signals are shown.

Note: PMCL version does not have this function due to the lack of 12-pin connector.

5.4.1 Iris video output

This signal can be used for lens iris control in Continuous and RCT modes.
The signal for iris video output is taken from the video signal after the gain control. The signal is 1.0 V p-p with sync.

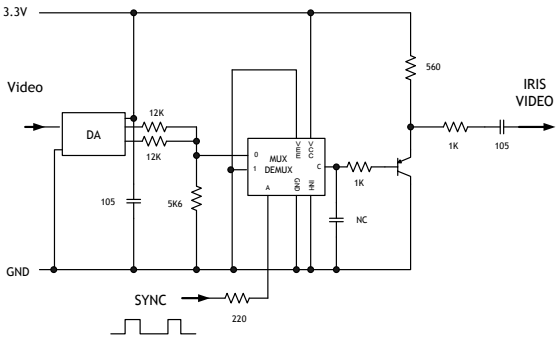


Fig.7. Iris video circuit

5.4.2 Trigger input

An external trigger input can be applied to pin 10 of 12-pin Hirose connector (when the command TI=1 has been set). The input is AC coupled. To allow long pulses the input circuit is designed as a flip-flop circuit. The leading and trailing edges of the trigger pulse activate the circuit.
The trigger polarity can be changed by TP=1.
Trigger input level 4 V ±2 V.
Trigger can also be applied through the Camera Link connector, when the command TI=0 has been sent.

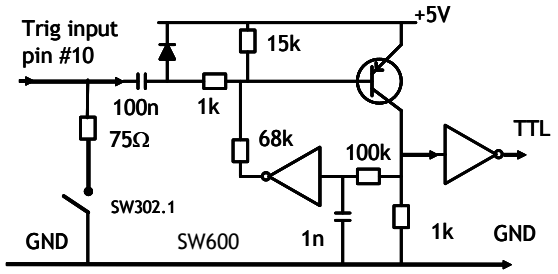


Fig. 8. Trigger input.

5.4.3 XEEN output

XEEN is on pin 9 on 12-pin HR connector. The output circuit is 75 Ω complementary emitter followers or open collector. They will deliver a full 5 volt signal.
When the open corrector is used, the maximum current is 120mA. If more than 50mA current is flowed, use large diameter cable. Otherwise, due to the resistance of the cable, malfunctions might be occurred.
This can be selected by a DIP switch located on the rear board. As changing the position requires removal of the circuit board, it is necessary to consult with JAI sales representatives.
Factory default is complementary emitter followers.

EEN is also found in Camera Link.

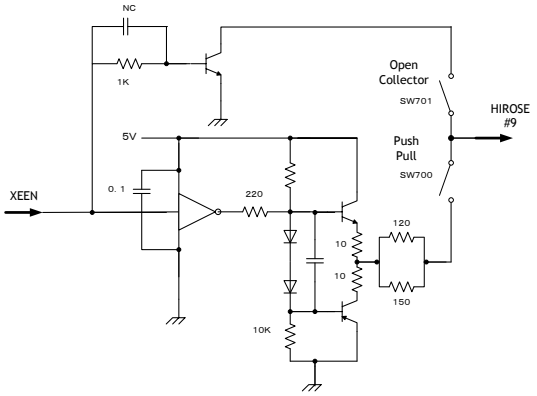


Fig. 9. XEEN output

5.4.4 Camera Link interface

The digital video is available via Camera Link, with 8-,10- or 12-bit pixel depth, using the CL Base configuration. The digital output signals follow the Camera Link standard using Channel Link chip sets.
The data bits from the digital video, FVAL, LVAL, DVAL and EEN are multiplexed into the twisted pairs, which are a part of the Camera Link. Trigger signals and the serial camera control are feed directly through its own pairs.

The 26-pin Mini-CL SDR connector pin assignment follows the Camera Link base configuration.

For a detailed description of the Camera Link standard, please refer to the Camera Link standard specifications found on AIA web site, www.machinevisiononline.org.

Pixel rate	58MHz			
Port/Signal	8bit	10bit	12bit	Pin No.
Port A0	D4	D2	D0	Tx0
Port A1	D5	D3	D1	Tx1
Port A2	D6	D4	D2	Tx2
Port A3	D7	D5	D3	Tx3
Port A4	D8	D6	D4	Tx4
Port A5	D9	D7	D5	Tx6
Port A6	D10	D8	D6	Tx27
Port A7	D11	D9	D7	Tx5
Port B0	NC	D10	D8	Tx7
Port B1	NC	D11	D9	Tx8
Port B2	NC	NC	D10	Tx9
Port B3	NC	NC	D11	Tx12
Port B4	NC	NC	NC	Tx13
Port B5	NC	NC	NC	Tx14
Port B6	NC	NC	NC	Tx10
Port B7	NC	NC	NC	Tx11
Port C0	NC	NC	NC	Tx15
Port C1	NC	NC	NC	Tx18
Port C2	NC	NC	NC	Tx19
Port C3	NC	NC	NC	Tx20
Port C4	NC	NC	NC	Tx21
Port C5	NC	NC	NC	Tx22
Port C6	NC	NC	NC	Tx16
Port C7	NC	NC	NC	Tx17
LVAL				Tx24
FVAL				Tx25
DVAL				Tx26
EEN				Tx23

5.4.5 Video Output Bit allocation

CCD out		Analogue Out (Equivalent)	Digital Out		
			8bit	10bit	12bit
Black	0%	Setup 3.6%, 25mV	8LSB	32LSB	128LSB
300mV	100%	700mV	222LSB	890LSB	3560LSB
342mV ↑	114%	800mV	255LSB	1023LSB	4095LSB

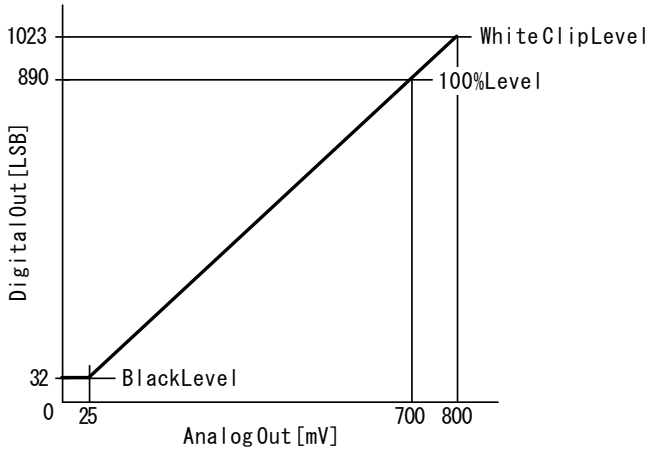


Fig.10. Digital output (10bit output)

6. Functions and Operations

6.1. Basic functions

The CM-141MCL and CB-141MCL cameras are progressive scan cameras with 12-, 10- or 8-bit video output via a Mini Camera Link interface. The cameras have 2/3, 1/2, 1/4 or 1/8 partial scanning or variable partial scanning for faster frame rates. Vertical binning mode is also available on monochrome version.
The camera can operate in continuous mode as well as in 4 triggered modes:

- Edge Pre-select Trigger (EPS)
- Pulse Width Control Trigger (PWC)
- Reset Continuous Trigger (RCT)
- Smear less EPS Trigger (EPS)

Depending on the timing of the trigger input in relationship to FVAL (camera internal frame valid clock), the start of exposure can be immediate (no-delay, LVAL asynchronous) or delayed until next LVAL (LVAL synchronous).
In the following section the functions are described in detail.

6.1.1 Vertical Binning (CM-141MCL only)

The binning functions can be used to achieve higher frame rate or higher sensitivity. The drawback is lower resolution.
Vertical binning is done by adding the charge from pixels in adjacent lines in the horizontal CCD register. Fig.11 shows the vertical binning principle.

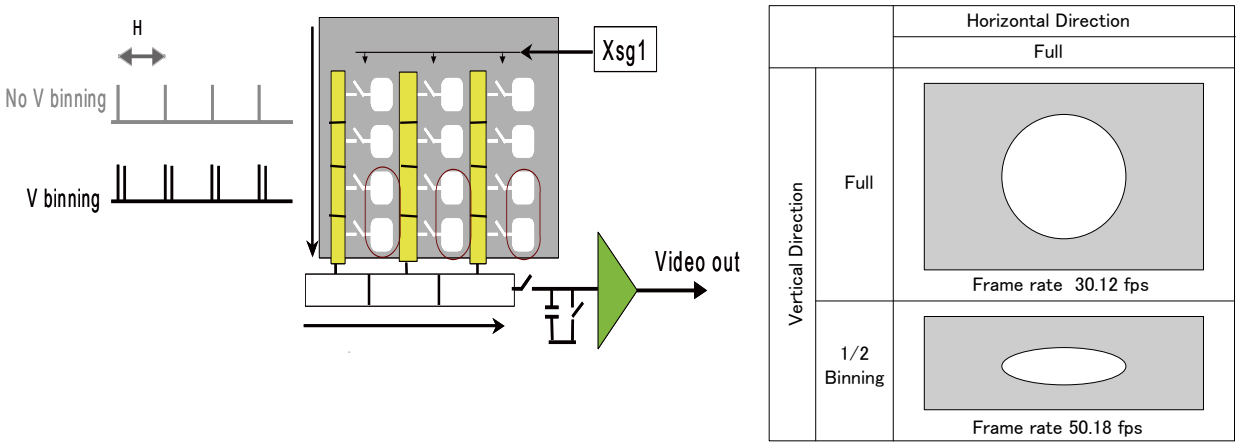


Fig.11. CM-141MCL Vertical binning.

The CM-141MCL has ON or OFF function for Vertical Binning:

Setting	Resolution	Frame rate
Off (no binning)	1392(h) x 1040(v) pixels	30.12 frames/sec.
2:1 binning	1392(h) x 520(v) pixels	50.18 frames /sec.

6.1.2 CB-141MCL Bayer mosaic filter

CB-141MCL is a color camera based on a CCD sensor with a Bayer RGB color mosaic.
The color image reconstruction is done in the host PC.
The color sequence in the video signal is the same for all scanning formats.

The line readout follows LVAL.
The first valid pixel is the same timing as DVAL.

The Bayer color sequence starts with:

- RGR for odd line numbers.

When the variable partial scan is used and an even line is selected as the start line, color sequence is;

- GBG for even line numbers.

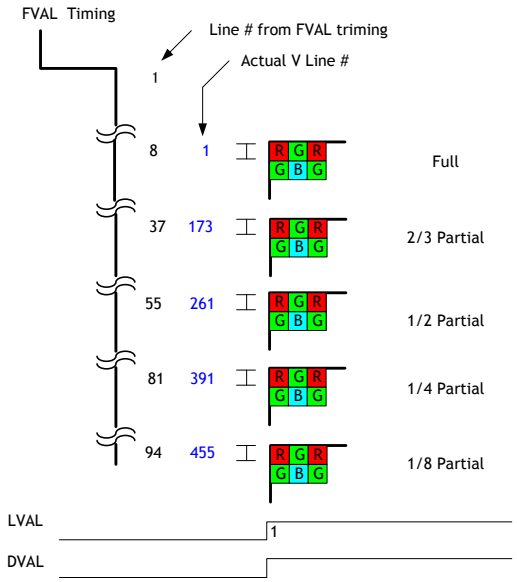
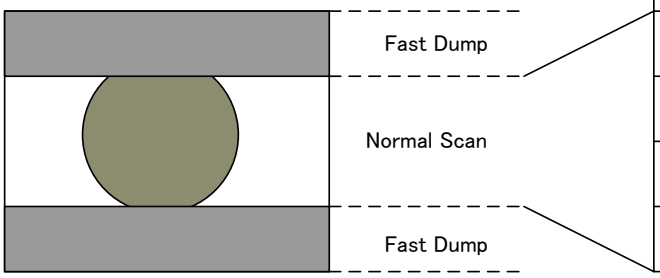


Figure 12 shows the timing sequence for the Bayer mosaic read-out for the available partial scan modes.

Fig.12. Bayer layout for each scanning

6.1.3 Partial Scanning (fixed rate and variable)

The partial scanning function uses the middle of the image vertically to achieve faster frame rates. This is very useful when capturing and inspecting an image which does not require full height. CM-141MCL/CB-141MCL has 4 types of partial scan modes such as 2/3, 1/2, 1/4 an 1/8.



Mode	Start line	End line	Frame Rate
2/3	173	866	41.05 fps
1/2	261	780	50.06 fps
1/4	391	650	74.57 fps
1/8	455	584	98.73 fps

Fig.13. Fixed partial scan

In addition to the fixed rate partial scan modes, CM/CB-141MCL has a variable partial scan mode. The start line can be set from the 1st line to the 1024th line and the scanned lines can be set from 8 lines to 1032 lines. Please note that if an odd line is selected as the start line, the Bayer color sequence is RGR and if an even line is selected, it is GBG.

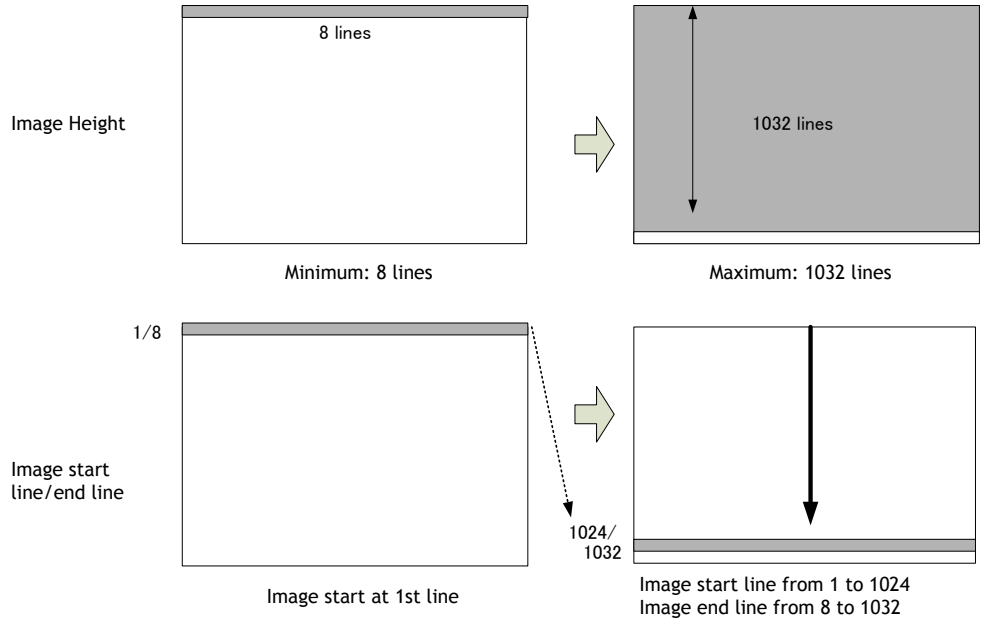


Fig.14. variable partial scan

◆ **How to calculate total line number and frame rate in variable partial scan mode**

Variable partial scan The start line setting 1st line to 1024nd line
Read out height 8 lines to 1032 lines

Total lines = OB period in the upper part of the frame (L) + Fast Dump period in the upper part of the frame (L) + Effective image period (L) + Fast dump period in the lower part of frame(L)
Where, OB period in the upper part of the frame 3L

Fast dump period for the upper part $Roundup\frac{StartlineNo.+7}{5}+2$

Fast dump period for the lower part $Roundup\frac{1039-EndLineNo.}{5}+2$

Frame rate (fps) = 1000000 / (Horizontal pixel No x Pixel clock x Total lines)

Horizontal Pixel number 1830
Pixel clock 17.24138 ns

Calculation example
Read out: 1/2 partial at the center (520L), Stat line (261), End line (780)

OB period in the upper part of the frame 3L
Fast dump period for the upper part = (261+7) ÷ 5 +2 = 55.6 → 56
Fast dump period for the lower part = (1039-780) ÷ 5 +2 =53.8 → 54
Total lines = 3+56+520+54=633
Frame rate = 1000000 ÷ (1830 ×17.24138 × 633) = 50.06 fps

6.1.4 Electronic Shutter

CM-141MCL / CB-141MCL has conventional shutter functions such as preset shutter and programmable shutter as well as a new function of fine exposure.

Preset Shutter
9 steps of preset shutter are available: OFF (1/30);
1/60,1/100,1/250,1/500,1/1,000,1/2,000, 1/4,000,1/8,000,1/10,000 sec.

Programmable Shutter
It is possible to set the shutter speed in the range of 2L to 1052L by 1L unit, in the case of Full Frame operation. When1052L is set, it is the equivalent of "OFF (1/30)" or33.19ms.

	Minimum Shutter Time 2L	Maximum Shutter Time
Normal	31.551 μs(1L) * 2L = 63.102 μs	31.551 μs * 1052 L≈ 33.192 ms
V Binning	37.810 μs * 2L = 75.62 μs	37.810 μs * 527 L ≈ 19.926 ms

Fine Exposure
This function sets the exposure in 1 pixel units, enabling a much more detailed exposure setting to be achieved. This can be done with a combination of programmable exposure setting (PE) and fine exposure setting (FE). When programmable shutter is set at PE=2, the fine exposure function can activate faster shutter speeds from 1/15847 to 1/85149. To set the function, the FE command is used.
PE=2, FE=0 Shutter speed = 1/85149
PE=2, FE=2979 Shutter speed = 1/15847

Exposure time can be calculated by the following formula.

- When the read out is full scanning,
  Exposure time (μs) = { PE(L) x 31.551(μs) –[{2979 – FE(Pixel Clock)} x 0.01724(μs)]

- When the read out is vertical binning scanning,
  Exposure time (μs) = { PE(L) x 37.81(μs) –[{2979 – FE(Pixel Clock)} x 0.01724(μs)]

- Where,
  PE ≥ 2
  FE ≤ 4095

Pulse Width Control
When this mode is selected, the exposure time is controlled by the width of the trigger pulse. The minimum trigger pulse width is equal to 2L (63μs) and the recommended maximum is 2 seconds.

6.1.5 Auto-Iris Lens video output (12-pin Hirose connector)

This analogue signal is available at pin 4 of 12-pin Hirose connector. It can be used for lens iris control in continuous mode and RCT mode only. This output is always effective.
As the signal is taken after the CCD sensor output passes through the gain circuit, the gain setting is influenced. The video output is with sync signal. The level is 1.0V. PMCL models do not have this function.

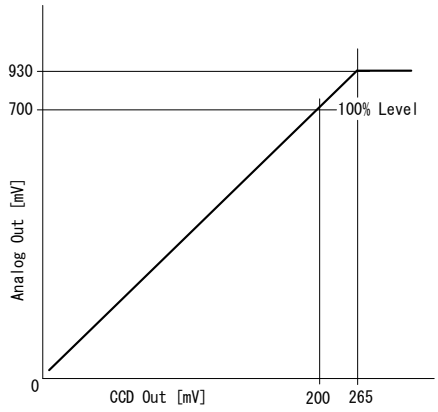
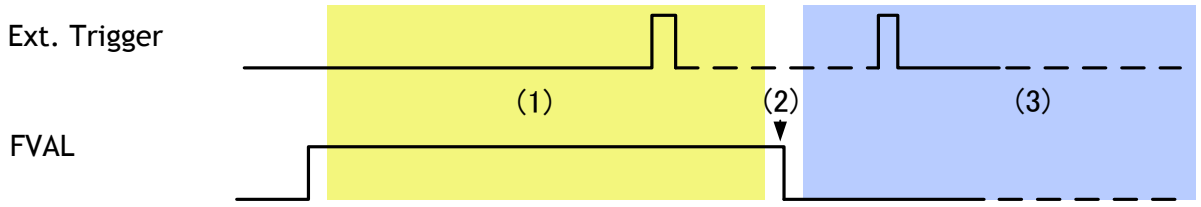


Fig. 15. Iris Video

6.1.6 Auto-detect LVAL-sync / async accumulation

This function replaces the manual setting found in older JAI cameras. Whether accumulation is synchronous or asynchronous in relationship to LVAL depends on the timing of the trigger input.
When a trigger is received while FVAL is high (during readout), the camera works in LVAL-synchronous mode, preventing reset feed-through in the video signal. There is a maximum jitter of one LVAL period from issuing a trigger and accumulation start.
When a trigger is received while FVAL is low, the camera works in LVAL-asynchronous mode, (no delay) mode.

This applies to both edge pre-select (EPS) trigger mode and pulse width trigger (PWC) mode.



(1) In this period camera executes trigger at the next LVAL. (Prevents feed-through noise)
(2) Avoid trigger at FVAL transition (+ / - 1 LVAL period), as the function may randomly switch between “next” and “immediate”.
(3) In this period camera executes trigger immediately. (No delay)

Fig. 16. Auto-detect LVAL sync / async accumulation

6.1.7 Rear panel indicator.

The rear panel mounted LED provides the following information:

Power /Trig LED

- Amber: Power connected – initiating
- Steady green: Camera is operating in continuous mode
- Flashing green: The camera is receiving an external trigger

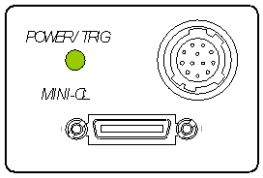


Fig.17 Rear Panel(CM/CB-141MCL)

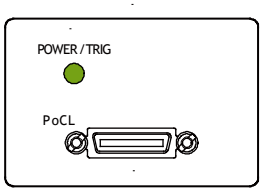


Fig.18 Rear Panel(CM/CB-141PMCL)

.

6.2. Sensor Layout and timing

6.2.1 CCD Sensor Layout

The CCD sensor layout with respect to pixels and lines used in the timing and video full frame read out is shown below.

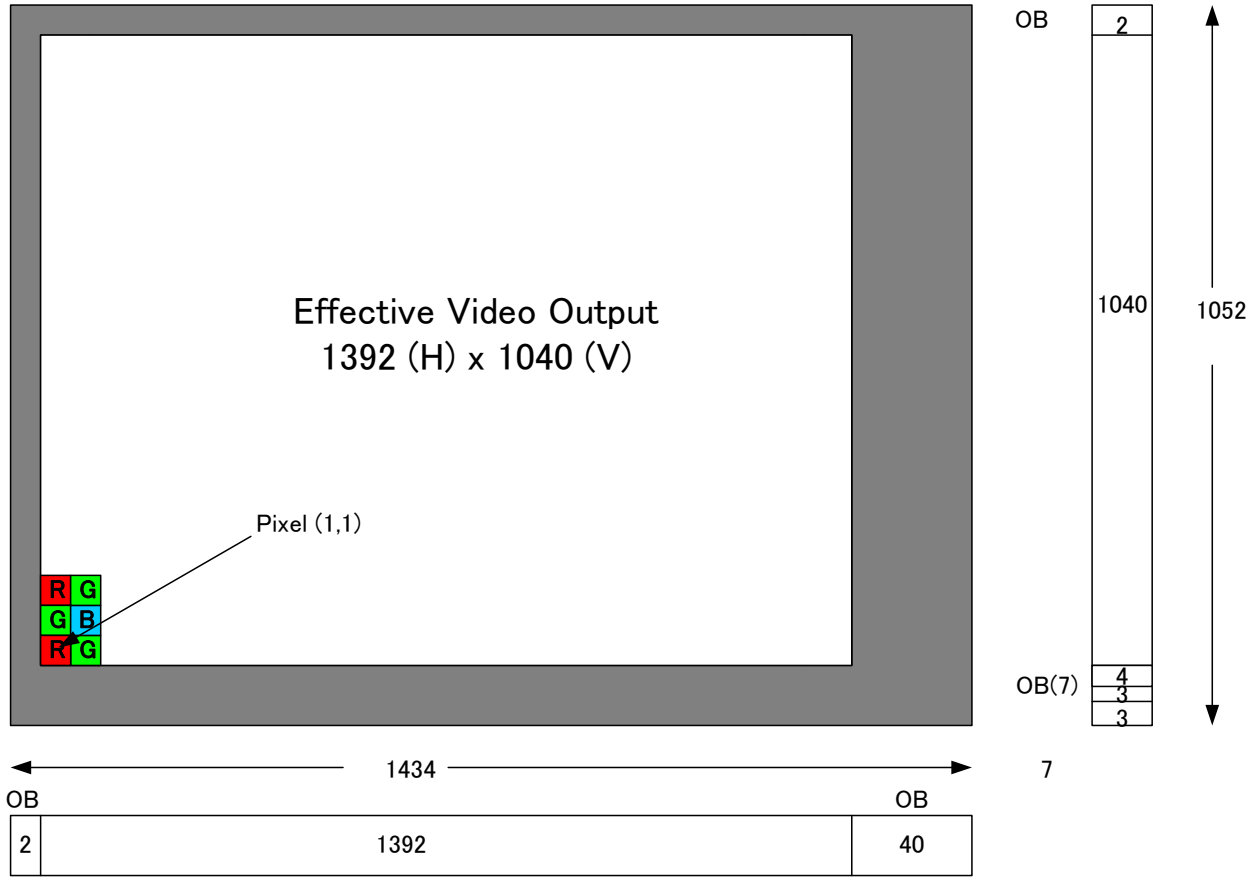


Fig.19 CCD sensor layout

Important Note: By using Optical Black (OB) transfer mode, the user can select whether to include optical black pixels in the image stream. This is for horizontal only.

6.2.2 Horizontal timing

The LVAL period is shown for normal continuous mode.

1 LVAL 1830 clk=31.551 us 1clk=17.241 ns

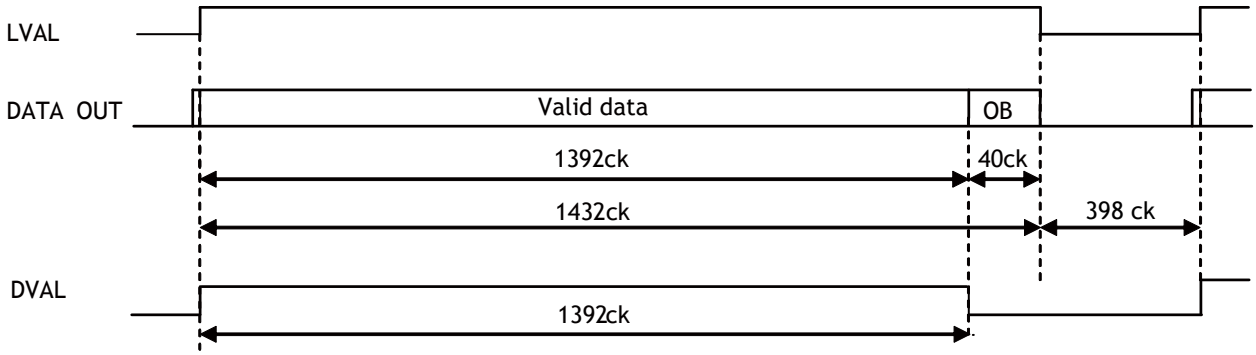


Fig.20 Horizontal timing

6.2.3 Vertical timing

The FVAL period for normal continuous mode full scan is shown.

FULL FRAME READ OUT FRAME RATE 1052L 30.12 fps

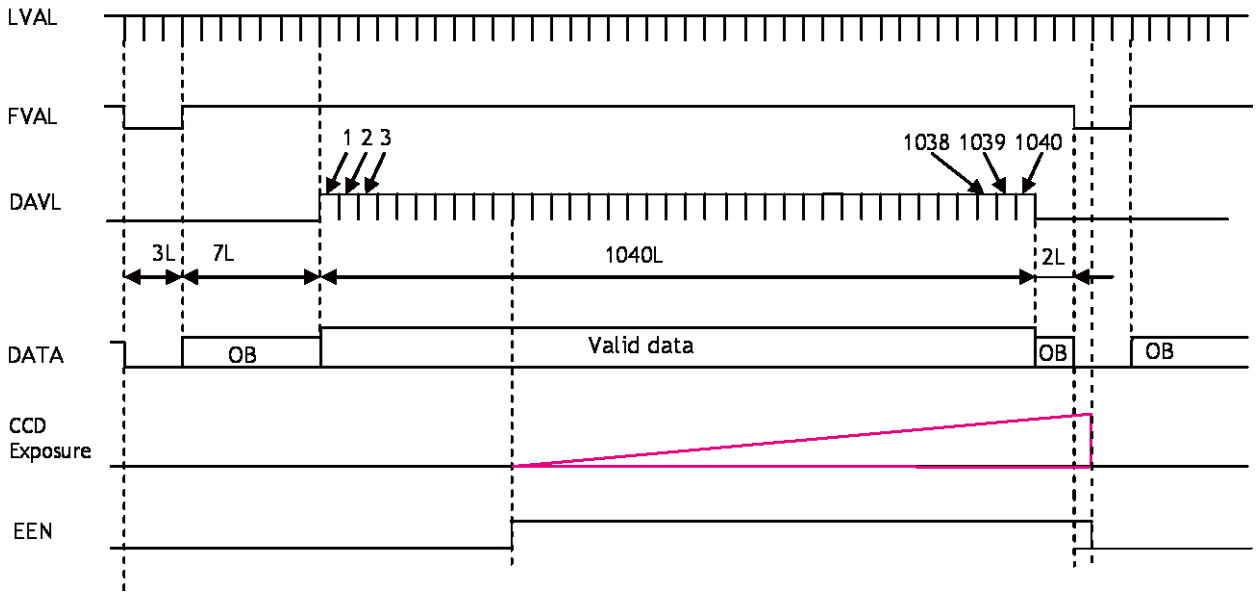


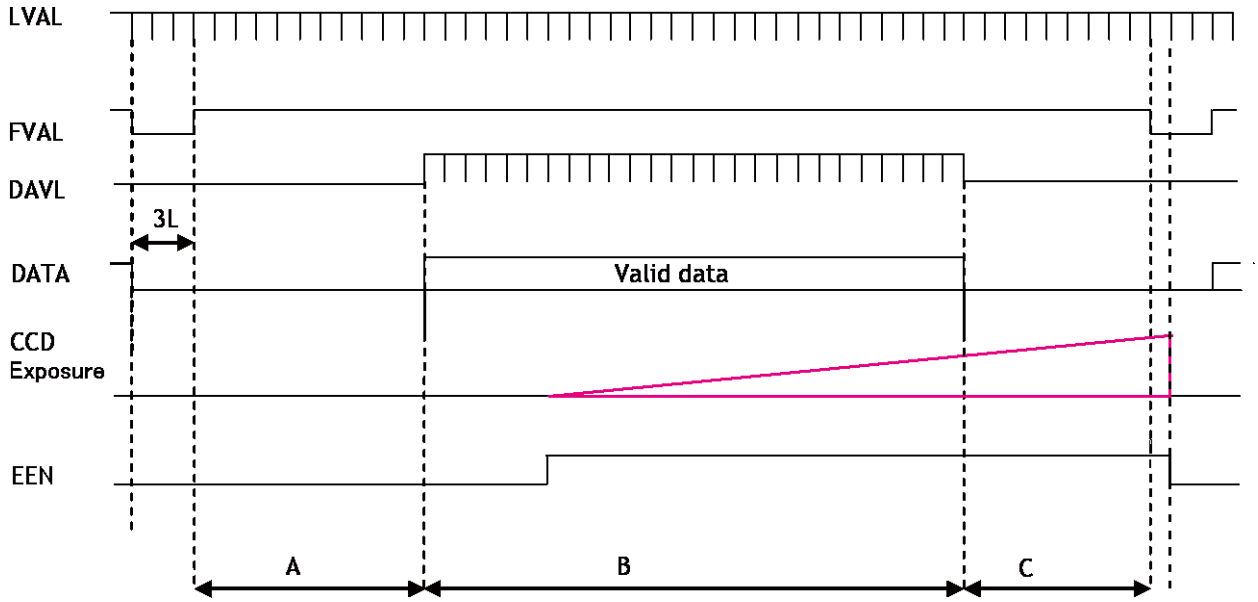
Fig.21 Vertical timing for full scan

6.2.4 Partial Scanning

The FVAL period is shown for 1/2 partial scan in normal continuous mode.

Vertical Timing

The diagram and table below provide vertical timing information for the fixed partial scan settings 1/2, 1/4, 1/3 and 2/3.



Values for vertical timing in partial scan continuous mode.

AREA	FVAL Low (L)	A (L)	B (L)		C (L)	Total line	frame rate
			Start line	End line			
2/3	3	38	694		37 L	772 L	41.05
			173	866			
1/2	3	56	520		54 L	633 L	50.06
			261	780			
1/4	3	82	260		80 L	425 L	74.57
			391	650			
1/8	3	95	130		93 L	321 L	98.73
			455	584			

Fig.22 Vertical timing for partial scanning

Horizontal Timing

The horizontal timing is the same as that of the full scanning.

1 LVAL 1830 clk=31.551 us 1clk=17.241 ns

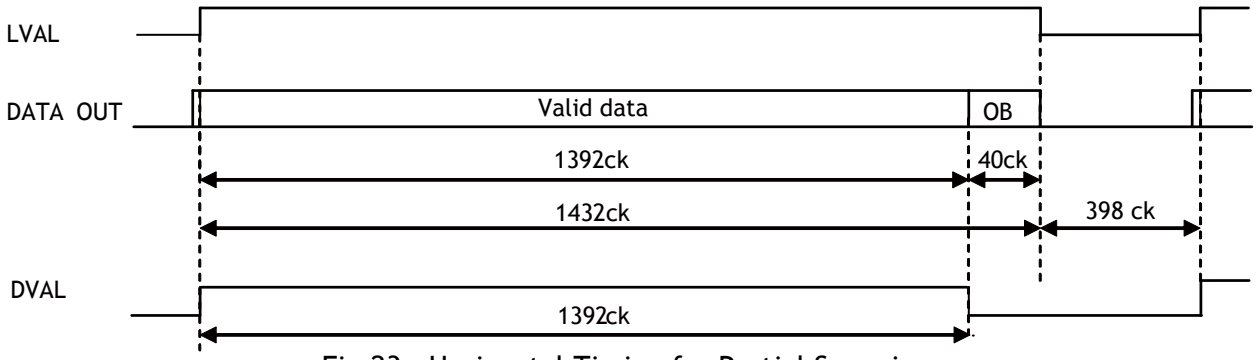


Fig.23 Horizontal Timing for Partial Scanning

6.2.5 Vertical binning

Vertical binning combines charge from two adjacent lines, reducing the vertical resolution to half and at the same time increasing frame rate and sensitivity. By activating this function, the frame rate is increased to 50.18 fps.
This function is available only for CM-141MCL/141MCL-RA.

Important Note
Vertical Binning cannot be used together with Partial Scanning.

Horizontal Timing

Vertical Binning
1LVAL 2193 ck=37.810 us
1ck=17.241 us

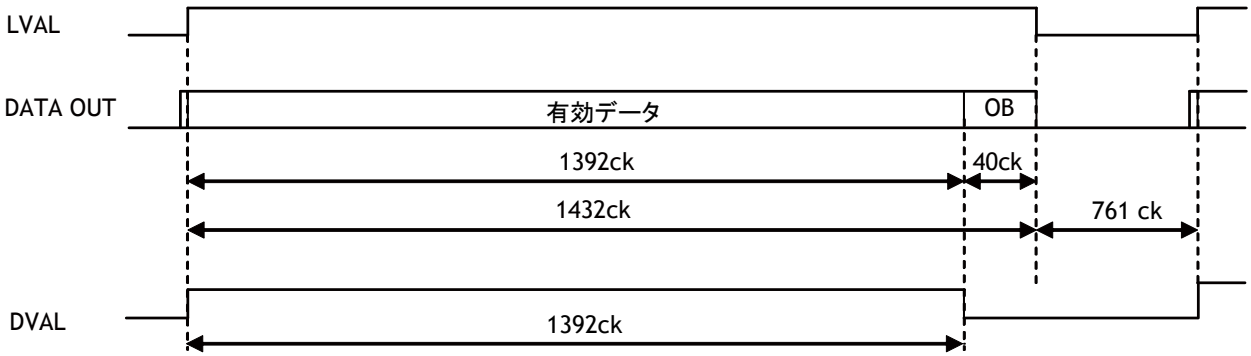


Fig.24 Horizontal Timing for Vertical Binning

Vertical timing
Vertical Binning FRAME RATE 527L 50.18 fps

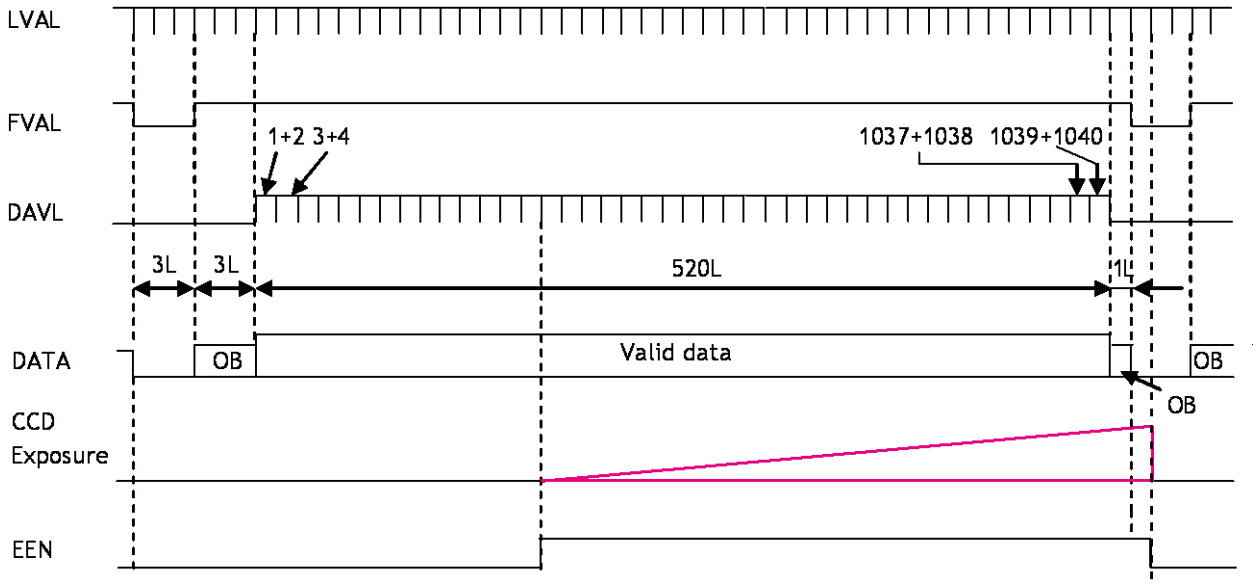


Fig.25 Vertical Timing for Vertical Binning

6.3. Operation Modes

This camera can operate in 5 primary modes.

*1. **Continuous Mode***	Pre-selected exposure.
*2. **Edge Pre-select Mode (EPS)***	Pre-selected exposure.
*3. **Pulse Width Control Mode (PWC)***	Pulse width controlled exposure.
*4. **Reset Continuous Trigger Mode(RCT)***	Pre-select exposure
*5.**Smearless EPS Mode***	Pre-select exposure

6.3.1 Continuous operation

For applications not requiring asynchronous external triggering, this mode should be used. In continuous mode it is possible to use a lens with video controlled iris.
For timing details, refer to fig. 20 through fig. 25.

To use this mode:

Set function:	Trigger mode	Continuous
	Scanning	Full, Partial
	Vertical binning	On/Off (CM-141MCL only)
	Shutter mode	Preset, Programmable, Fine Exposure
	Shutter speed	1/30 to 1/10,000
	Programmable exposure	2 to 1052 L

6.3.2 Edge Pre-select (EPS) Trigger Mode

An external trigger pulse initiates the capture, and the exposure time (accumulation time) is the fixed shutter speed set by registers. The accumulation can be LVAL synchronous or LVAL asynchronous. The resulting video signal will start to be read out after the selected shutter time.
For timing details, refer to fig. 20 through fig. 27.

To use this mode:

Set function:	Trigger mode	EPS
	Scanning	Full, Partial
	Vertical binning	ON / OFF (CM-141MCL only)
	Shutter mode	Preset, Programmable, Fine Exposure
	Shutter speed	1/60 to 1/10,000
	Programmable exposure	2 L to 1052 L
	Accumulation (Auto)	LVAL Sync / LVAL a-sync
	Other functions and settings	
Input:	External trigger	12-pin Hirose or Camera Link

Important notes on using this mode

- Trigger pulse >2 LVAL to <1 FVAL)
- The following table shows minimum trigger interval in synchronous accumulation mode

Full scan	1054 L
2/3 Partial	774 L
1/2 Partial	635L
1/4 Partial	427 L
1/8 Partial	323 L
1/2 V Binning	529 L

In the case of asynchronous mode, the exposure time should be added to the above table.

LVAL sync timing

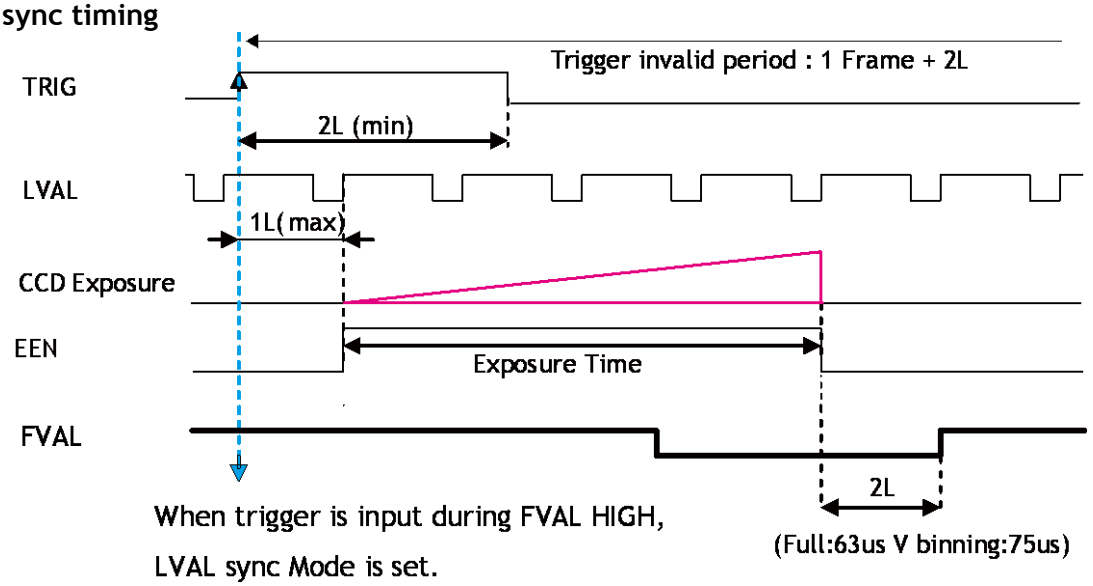


Fig. 26 Edge Pre-select LVAL sync Timing

LVAL async timing

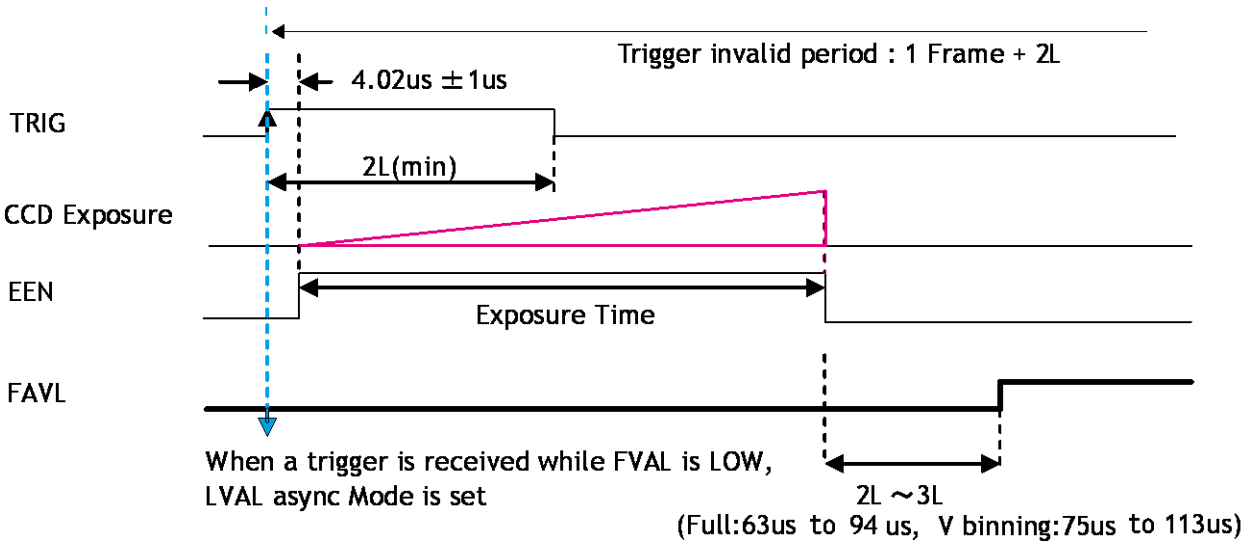


Fig.27 Edge Pre-select LVAL a-sync Timing

6.3.3 Pulse Width Control (PWC) Trigger Mode

In this mode the accumulation time is equal to the trigger pulse width. Here it is possible to have a long time exposure. The maximum recommended time is <2 seconds.
The accumulation can be LVAL synchronous or LVAL asynchronous.
The resulting video signal will start to be read out after the trigger rising edge.
For timing details, refer to fig. 20 through fig. 25 and fig.28 and 29.

To use this mode:

Set function:	Trigger mode	PWC
	Scanning	Full, Partial
	Vertical binning	ON / OFF (CM-141MCL only)
	Accumulation (Auto)	LVAL sync / LVAL a-sync
	Other functions and settings	
Input:	External trigger	12-pin Hirose or Camera Link

Important notes on using this mode

- Trigger pulse width >2LVAL to <2 seconds
- The following table shows minimum trigger interval in synchronous accumulation mode

Full scan	1054 L
2/3 Partial	774 L
1/2 Partial	635 L
1/4 Partial	427 L
1/8 Partial	323 L
V Binning	529 L

In the case of asynchronous mode, the exposure time should be added to the above table.

LVAL sync timing

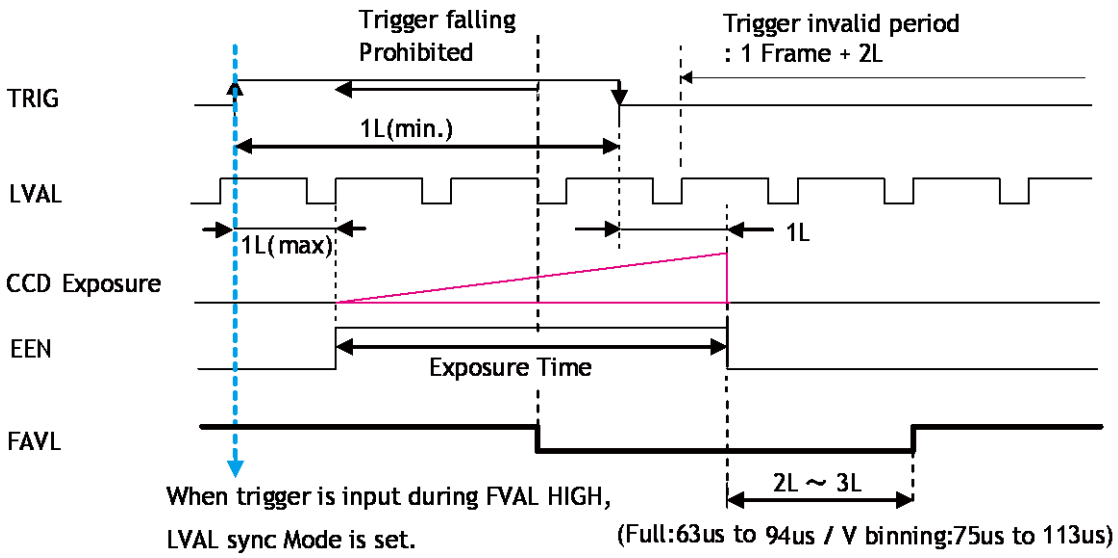


Fig.28 Pulse width control LVAL sync.

LVAL async timing

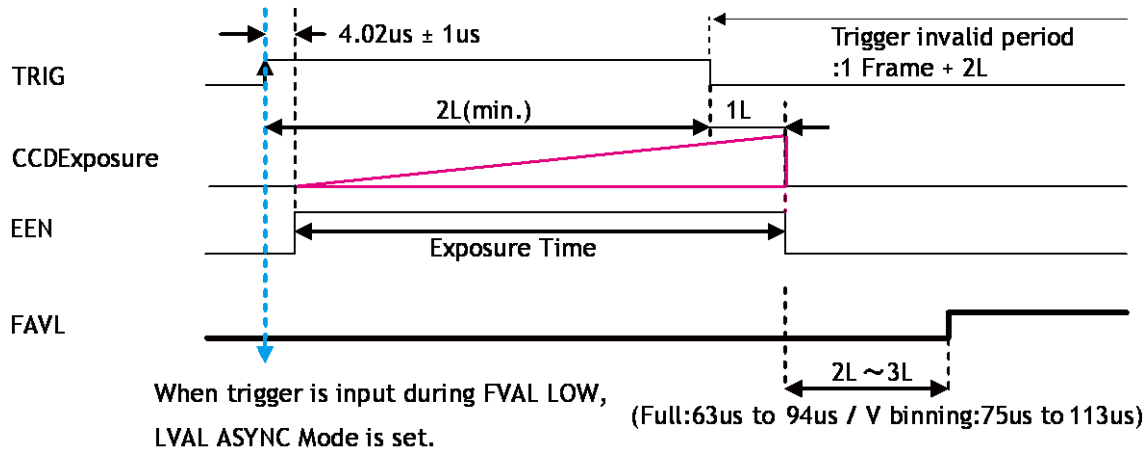


Fig.29 Pulse Width control LVAL async

6.3.4 Reset Continuous (RCT) trigger mode

The RCT mode operates like EPS(edge preselect)mode with smear less function. An external trigger pulse will immediately stop the video read out, reset and restart the exposure, then operate as normal mode until the next trigger. After the trigger pulse is input, a fast dump read out is performed. In the CM-141MCL/ CB-141MCL, this period is 6.65ms which is 211L. The exposure time is determined by the pre-set shutter speed. If no further trigger pulses are applied, the camera will continue in normal mode and the video signal is not output. The fast dump read out has the same effect as "smear less read out". Smear over highlight areas is reduced for the trigger frame. The reset continuous trigger mode makes it possible to use triggering in conjunction with a lens with video controlled iris.

To use this mode:

Set function:	Trigger mode	RCT
	Scanning	Full, Partial
	Vertical binning	ON / OFF (CM-141MCL only)
	Shutter mode	Preset, Programmable, Fine Exposure
	Shutter speed	1/60 to 1/10000
	Programmable exposure	2L to 1052 L
	Accumulation	LVAL async only
	Other functions and settings	
Input:	External trigger	12-pin Hirose or Camera Link

Important notes on using this mode

- Trigger pulse >2 LVAL to <1 FVAL)
- The following table shows minimum trigger interval in synchronous accumulation mode

Full scan	1268 L
2/3 Partial	989 L
1/2 Partial	850 L
1/4 Partial	642 L
1/8 Partial	438 L
1/2 V Binning	744 L

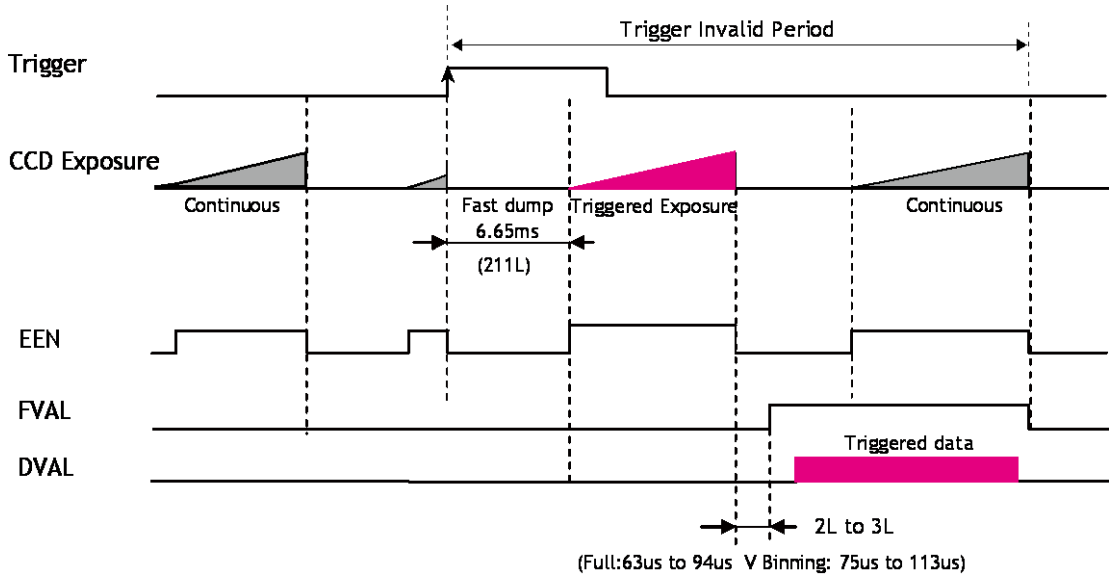


Fig.30 RCT mode timing

6.3.5 Smear less EPS Trigger mode

This mode is EPS trigger mode with smear less function. Once the external trigger is input, a fast dump is activated. Then exposure starts with the preset shutter speed.
This mode can eliminate smear on the upper part of the image.

This mode functions only in LVAL asynchronous mode.

To use this mode:

Set function:	Trigger mode	Smear less Edge PreSelect
	Scanning	Full, Partial
	Vertical binning	ON / OFF (CM-141MCL only)
	Shutter mode	Preset, Programmable, Fine Exposure
	Shutter speed	1/60 to 1/10,000
	Programmable exposure	2L to 1052 L
	Accumulation	LVAL async only
	Other functions and settings	
Input:	Ext. trigger.	12-pin Hirose or Camera Link

Important notes on using this mode

- Trigger pulse >2 LVAL to <
- The following table shows minimum trigger interval in synchronous accumulation mode

Full scan	1268 L
2/3 Partial	989 L
1/2 Partial	850 L
1/4 Partial	642 L
1/8 Partial	438 L
1/2 V Binning	744 L

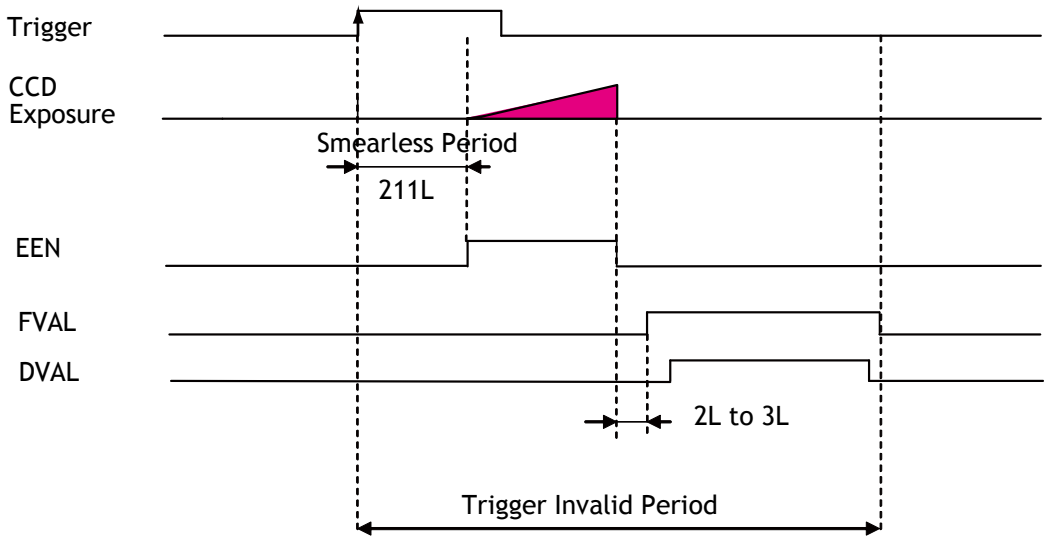


Fig.31 Smearless EPS mode timing

6.4. Operation Mode and Functions matrix

ID Value	Mode	Shutter Preset / Program.	Vertical Binning (Note 1)	Partial Scanning	LVAL Sync/ Async	Auto Iris output (Note 3)
0	Continuous	Yes	Yes	Yes	---	Yes
1	Edge Pre-select (PS)	Yes	Yes	Yes	Auto	No
2	Pulse Width Control (PW)	Not applicable	Yes	Yes	Auto	No
3	RCT	Yes	Yes	Yes	Async	Yes
4	Smearless EPS(Note2)	Yes	Yes	Yes	Async	No

Note 1: Vertical binning is available only for CM-141MCL.
Note 2: Smearless EPS modes suppress the smear on the upper part of the image.
Note 3: The auto iris output is only effective in normal scan and vertical binning modes. It is not available in partial scan mode.

7. Configuring the Camera

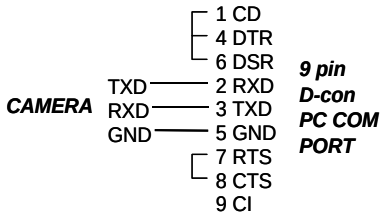
7.1 RS-232C control

All configuration of the CM-141MCL and CB-141MCL cameras is done via the RS-232C port on the 12 pin HR connector or via Camera Link. The camera can be set up from a PC running terminal emulator software, or using JAI's camera control software.
Below is the description of the ASCII based short command protocol.

Communication setting

Baud Rate	9600 bps
Data Length	8 bit
Start Bit	1 bit
Stop Bit	1 bit
Parity	None
Xon/Xoff Control	None

RS 232C cable



Protocol.

Transmit setting to camera:
NN=[Parameter]<CR><LF> (NN is any kind of command. Capital or small letters.)
The camera answers:
COMPLETE<CR><LF>

To have all communication visible on the emulator screen, start with:
EB=1<CR><LF>
The camera answers:
COMPLETE<CR><LF>

Transmit request command to camera:
NN?<CR><LF> (NN is any kind of command.)
The camera answers:
NN=[Parameter]<CR><LF>

Transmit the following to have the camera actual setting:
ST?<CR><LF>
The camera answers:
A complete list of the current settings

Transmit the following to have a command list:
HP?<CR><LF>
The camera answers:
A list with all commands and possible settings

Invalid parameters send to camera: (99 is an invalid parameter)
SH=99<CR><LF>
The camera answers:
02 Bad Parameters!!<CR><LF>

To see firmware number.
VN?<CR><LF>
To see camera ID. It shows the manufacturing lot number.
ID?<CR><LF>

7.2 Setting functions

7.2.1 Bit allocation. BA=0, BA=1, BA=2

This command sets the output from 8-bit , 10-bit or 12-bit.

7.2.2 Partial scan. SC=0 through 5.

The CCD scanning format can be selected between full or partial scanning. With partial scanning only the vertical central part of the CCD sensor is read out with a higher frame rate. The partial scan is done by a fast dump read out of the lines in the vertical CCD register down to the top of the partial image. This central part of the image is read out with normal speed. The lines below the partial image are read out and dumped with a high speed.
Note: The color sequence for CB-140 MCL differs in partial scan modes. Refer to chapter 6.3.

7.2.3 Vertical binning VB=0, VB=1

This function is only for CM-140MCL camera.
The CM-140MCL has only vertical binning mode. With V binning the pixel charge from 2 adjacent lines are added together in the horizontal CCD register. It is done by double pulses to the vertical CCD register. V Binning cannot be used together with partial scanning.

7.2.4 Shutter mode. SM=0 and SM=1

With SM=0 this function selects the shutter from the 9 fixed steps (SH=0 through SH=9SH). With SM=1 from programmable in 1051 steps (PE=2 through PE=1052). In association with programmable exposure, fine exposure function is available.

7.2.5 Trigger input select. TI=0, TI=1.

This function selects the trigger input to be through Camera Link (TI=0), or as TTL through the 12 pin Hirose connector (TI=1).

7.2.6 Trigger polarity. TP=0, TP=1.

The active trigger polarity is normally low (TP=0). It can be inverted it to active high (TP=1).

7.2.7 Gain level. GA=-84 through +670

GA=0 is 0dB gain, which is the normal working point. The range is from -3 dB to +24 dB.

7.2.8 Black level. BL=255 through BL=767.

Black level (or set-up level) will set the video level for black. Factory setting is 128LSB for 12-bit ,32 LSB for 10-bit or 8 LSB for 8-bit.

7.3 Save and Load Functions.

The following commands are for storing and loading camera settings in the camera EEPROM.

Load settings. *LD*.
This command will load previously stored settings to the camera. 3 user settings can be stored in the camera EEPROM. 1 factory setting is also stored in the camera. The settings stored in the last used user area are used as default settings at power up.

Save Settings. *SA*.
This command will store the actual camera settings to 1 of the 3 user areas in the camera EEPROM.

EEPROM Area. *EA*.
If received, the camera will return the last used user area number.

7.4 CM-140MCL / CB-140MCL command list

	Command Name	Format	Parameter	Remarks
A - General settings and utility commands.				
2	Camera Status Request	**ST**?<CR><LF>		Actual setting
3	Online Help Request	**HP**?<CR><LF>		Command list
4	Firmware Version	**VN**?<CR><LF>		3 digits (e.g) 100 = Version 1.00
5	Camera ID Request	**ID**?<CR><LF>		max 12 characters
6	Model Name Request	**MD**?<CR><LF>		max 12 characters
7	User ID	**UD**=[Param.]<CR><LF> UD?<CR><LF>		User can save and load free text.(12 or less characters)
B – Shutter				
1	Shutter Mode	**SM**=[Param.]<CR><LF> SM?<CR><LF>	0=Preset Shutter 1=Programmable exposure	
2	Preset Shutter	**SH**=[Param.]<CR><LF> SH?<CR><LF>	0=Off、1=1/60, 2=1/100、3=1/250、4=1/500、5=1/1000、6=1/2000、7=1/4000、8=1/8000、9=1/10000	Available when SM=0.
3	Programmable Exposure	**PE**=[Param.]<CR><LF> PE?<CR><LF>	2 to 1052	Available when SM=1.
4	Fine Exposure	**FE**=[Param.]<CR><LF> FE?<CR><LF>	0 to 4095	

	Command Name	Format	Parameter	Remarks
C - Trigger mode				
1	Trigger Mode	**TR**=[Param.]<CR><LF> TR?<CR><LF>	0=Normal (Continuous) 1=EPS(Edge pre select) 2=PWC(Pulse width control) 3=RCT 5=Smear Less EPS	
2	Trigger Polarity	**TP**=[Param.]<CR><LF> TP?<CR><LF>	0=Active Low 1=Active High	
3	Trigger Input	**TI**=[Param.]<CR><LF> TI? <CR><LF>	0=Camera Link 1=Hirose 12pin	
D -Image Format				
1	Bit Allocation	**BA**=[Param.]<CR><LF> BA?<CR><LF>	0=8bit, 1=10bit , 2=12bit	
2	Scan Format	**SC**=[Param.]<CR><LF> SC? <CR><LF>	0=Full Frame, 1=2/3 Partial 2=1/2 Partial, 3=1/4 Partial 4=1/8 Partial,5= Variable	
3	Variable partial start line	**STL**=[Param.]<CR><LF> STL? <CR><LF>	1 to 1024	
4	Variable partial end line	**ETL**=[Param.]<CR><LF> ETL? <CR><LF>	8 to 1032	
5	V-Binning	**VB**=[Param.]<CR><LF> VB?<CR><LF>	0=OFF 1=On	Only CM-141MCL
E - Gain, Black and signal settings				
1	Gain Level	**GA**=[Param.]<CR><LF> GA?<CR><LF>	-84 to 670	
2	Black Level	**BL**=[Param.]<CR><LF> BL?<CR><LF>	255 to 767	
F - Saving and loading data in EEPROM				
1	Load Setttings (from Camera EEPROM)	**LD**=[Param.]<CR><LF>	0=Factory area 1=User 1 area 2=User 2 area 3=User 3 area	Latest used DATA AREA becomes default at next power up.
2	Save Settings (to Camera EEPROM)	**SA**=[Param.]<CR><LF>	1=User 1 area 2=User 2 area 3=User 3 area Note : 0 is not allowed	
3	EEPROM Current Area No Request.	**EA**?<CR><LF>	0=Factory area 1=User 1 area 2=User 2 area 3=User 3 area	The camera return the latest used DATA AREA.

NOTE: Do not try to use commands not shown in this list.

8. Camera Control Tool for CM-141 MCL / CB-141 MCL

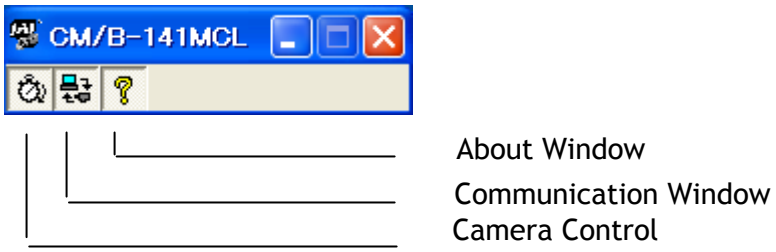
The Camera Control Tool for Windows 2000/XP can be downloaded from www.jai.com. The control tool contains a camera control program and a developer's kit for integrating the control tool in your own software. For the integrator and experienced user, the Camera Control Toll is much more than a program with a window interface. It also provides an easy and efficient ActiveX interface built for MS Windows 2000/XP. The OCX interface has the ability to connect to the camera using the serial interface of the PC by reading and writing properties for the camera. This integration requires simple programming skills within Visual Basic, Visual C++ or similar languages in a Microsoft Windows environment.

8.1 Camera Control Tool Interface

The Camera Control Tool Software is based on a main Tool Bar and a number of associated Tool Windows. Each button in the Tool Bar pops up a separate Tool Window when pressed. The layout of the program can be adjusted by arranging the windows the way it is preferred. The program will store this information and recreate this layout, when the program is restarted. All Camera Control Tools have a Communication Window and an About Window. The other window(s) contains camera control commands.

8.1.1 Camera Control Tool Bar

This is a Camera Control Tool Bar and when the button of each widow, each control GUI can be initiated.

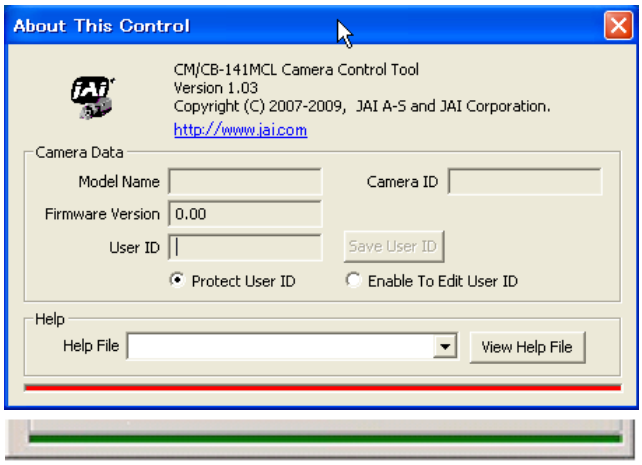


8.2 The About Window

The about window contains a picture of the camera and information about the version of the program, Internet connection to JAI A/S and access to the help documents.

The drop-down box labelled "Help File" will list all files which have the extension .pdf and that are found in the program (default) folder.

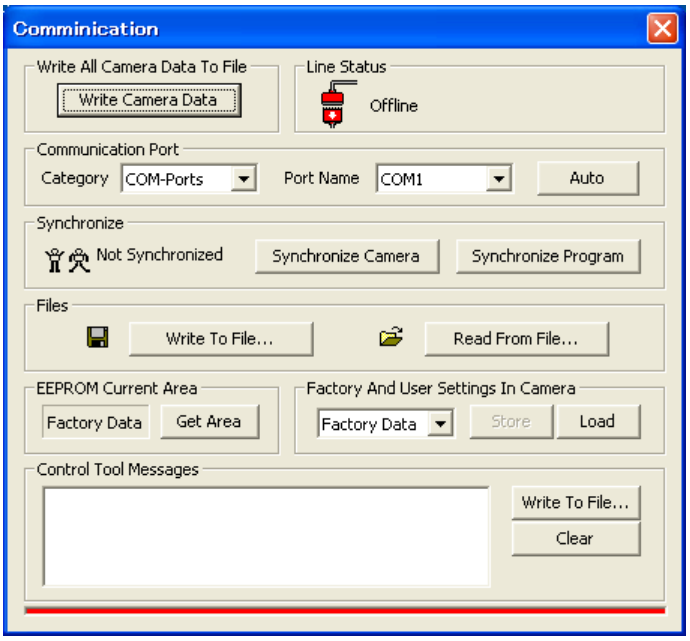
C:\Program Files\JAI A-S\"control tool name"



It is possible to download updated operation manuals from the JAI website:
http://www.jai.com/camera/manuals.asp/sprog=uk
An updated manual can be saved in the folder address mentioned above and it will automatically be included in the list of help files.

At the bottom of the windows (all windows but the Communication Window is a colored bar. The bar is green when the Camera Control Tool is connected to a camera and the camera is turned on. The bar is red when the Camera Control Tool is not connected to a camera or when the camera is turned off.

8.3 Communication Window



The Communication Window is used to connect the Camera Control Tool with the JAI camera.

Camera Link communication:
The CL Manufacturer/COM-ports' list box also contains DLL file names (or frame grabber names) for all Camera Link frame grabbers that are installed in the pc. This is done by using a DLL file called "clserial.dll" to upload all frame grabber DLLs that are found in the pc.
Just select the option for the frame grabber that is installed in the pc.

Auto search
Click the auto button to search for a camera on communication port 1 to 16. The camera control program automatically sends camera request on every communication port. The user is prompted to use a communication port if a camera answers the request.
This button is only used for RS-232 communication.

Off/On-line mode
The Camera Control Tool Application can run Offline (without a camera attached) and all functions are fully functional in offline mode.
Off line mode is indicated in The Communication Window, where a status field with graphic and text indicates the on/off-line status.
Changing the selected communication port (from the communication window) changes the online/off-line status. If a camera is found on the selected communication port the application runs online otherwise offline.

Changing the settings in the application will automatically update the camera settings when the application is online.
If the application loses connection with the camera it will automatically go to offline mode and it is indicated in the communication window.

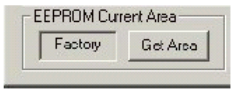
Synchronize program and camera
The Camera Control software has the ability to synchronize either the camera or the program. Click Synchronize camera to write all settings from the program to the camera or click the Synchronize program to load all settings from the camera to the program.

Files
When clicking the Write to File or Read from File button, the user is prompted for a file using a standard file dialog. New files are created if they do not already exist.
Files for camera settings have the extension cam. Information about the communication port is not stored in the files. All settings are automatically sent to the camera when a file has been loaded (if the camera is online).

Factory and User Settings
Use the Store button to store the current camera settings into the user settings area in EEPROM. Current camera settings are not saved when the camera is turned off. To save current camera settings you have to save them on the available user areas.
Use the Load button to restore previously saved camera settings from either the Factory or the User EEPROM area.

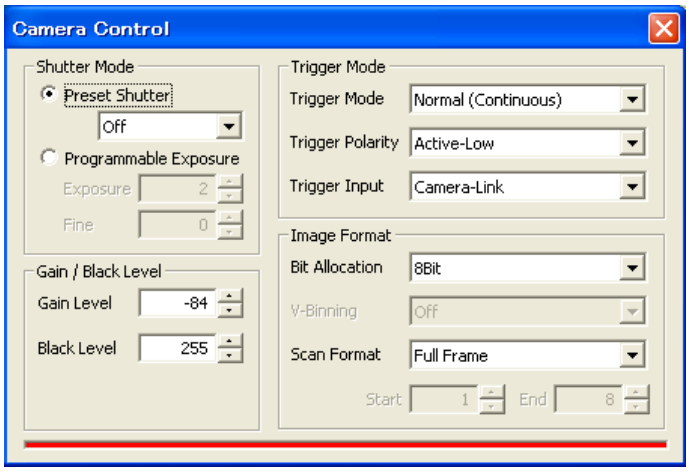
Write All Camera Data to File.
Click the "Write Camera Data" button to save all camera settings into a text file. The information that can be saved is:
Model Name, Camera ID, User ID, Firmware Version, Current Settings, Factory Settings and the available User Areas.
The file is formatted as shown in the picture below:

EEPROM Current Area.
Click the 'Get Area' button to read the power up settings area number.



8.4 Camera Control Window

The Camera Control Window contains the fundamental camera setting functions.
It is possible to set the shutter mode, Trigger mode, image format, scan format, gain control and black setting.

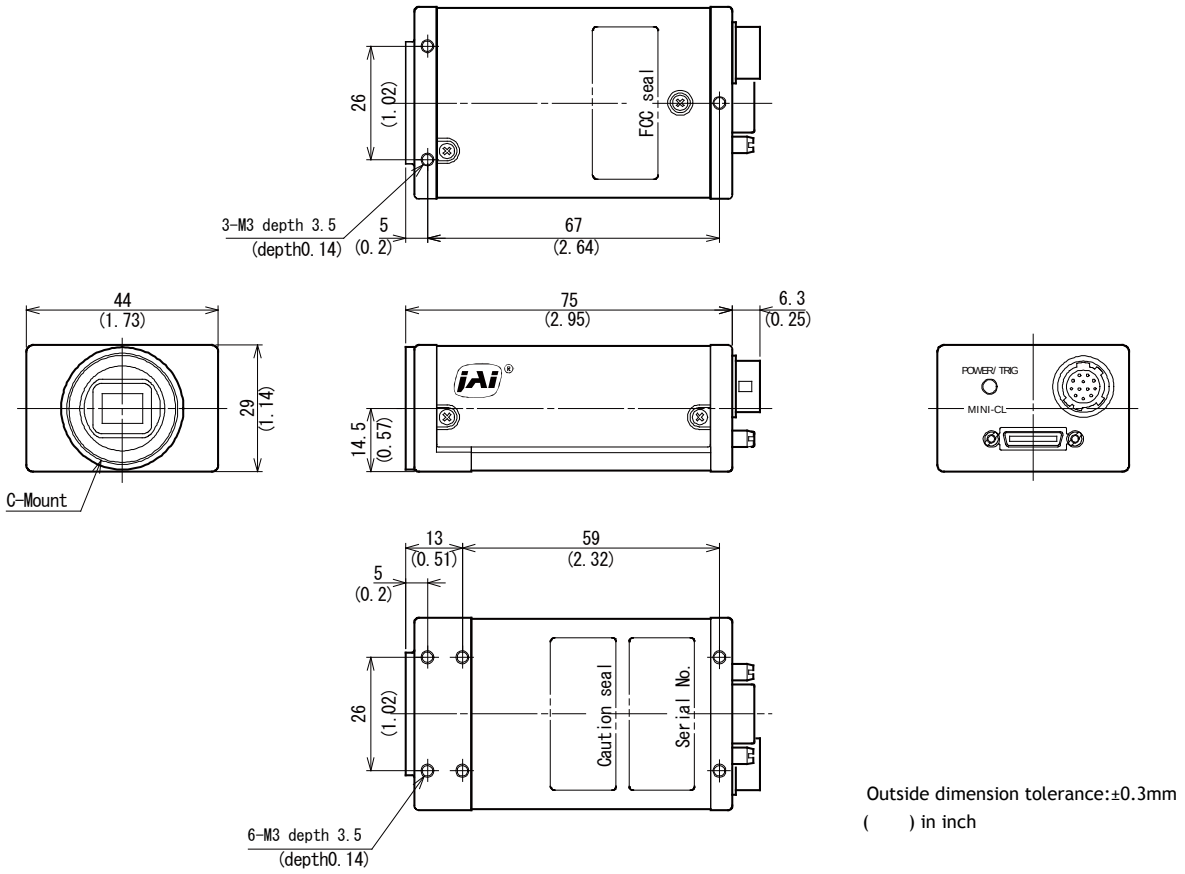


8.5 Using the Camera Control Tool

Here is some practical information about the Camera Control Tool:

1. The Camera Control Tool bar is always on top of other windows.
2. When you minimize the Camera Control Tool bar all open windows will close.
3. It is possible to work with the Camera Control Tool when the camera is online and when the camera is offline.
4. The newer JAI cameras always start up with the last used user area (but for some old models it will start up with the last saved user area.)
5. The Camera Control Tool saves the last used settings (not the user area), which don't have to be the same as for the last saved user area.
6. The setup file CameraName.ini stores all information about camera settings. When the program is started the last settings for the program are loaded from the file CameraName.ini
7. When you turn on the camera and the Camera Control Tool, it is possible that the Camera Control Tool does not show the actual camera settings (see 4 and 5.).
    a. To obtain the camera settings click "Synchronize Program".
    b. To send the settings that are saved in the Camera Control Tool (last used settings) to the camera click "Synchronize Camera".
    c. To see which area the camera has started up in click "Get Area".

9. External Appearance and Dimensions



Outside dimension tolerance:±0.3mm
( ) in inch

Fig.32 Outline for CM/CB-141MCL

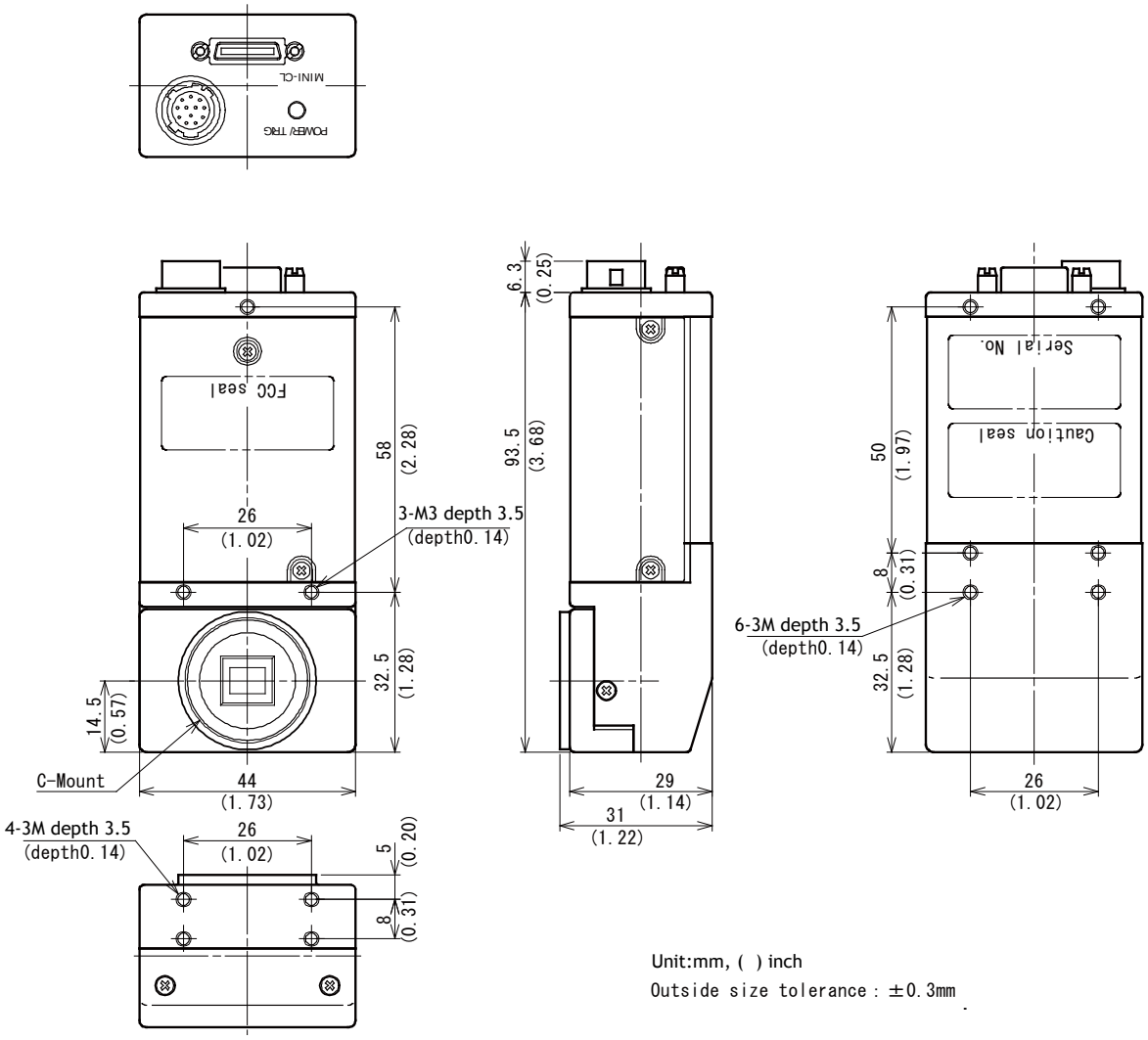


Fig.33 Outline for CM/CB-141MCL-RA

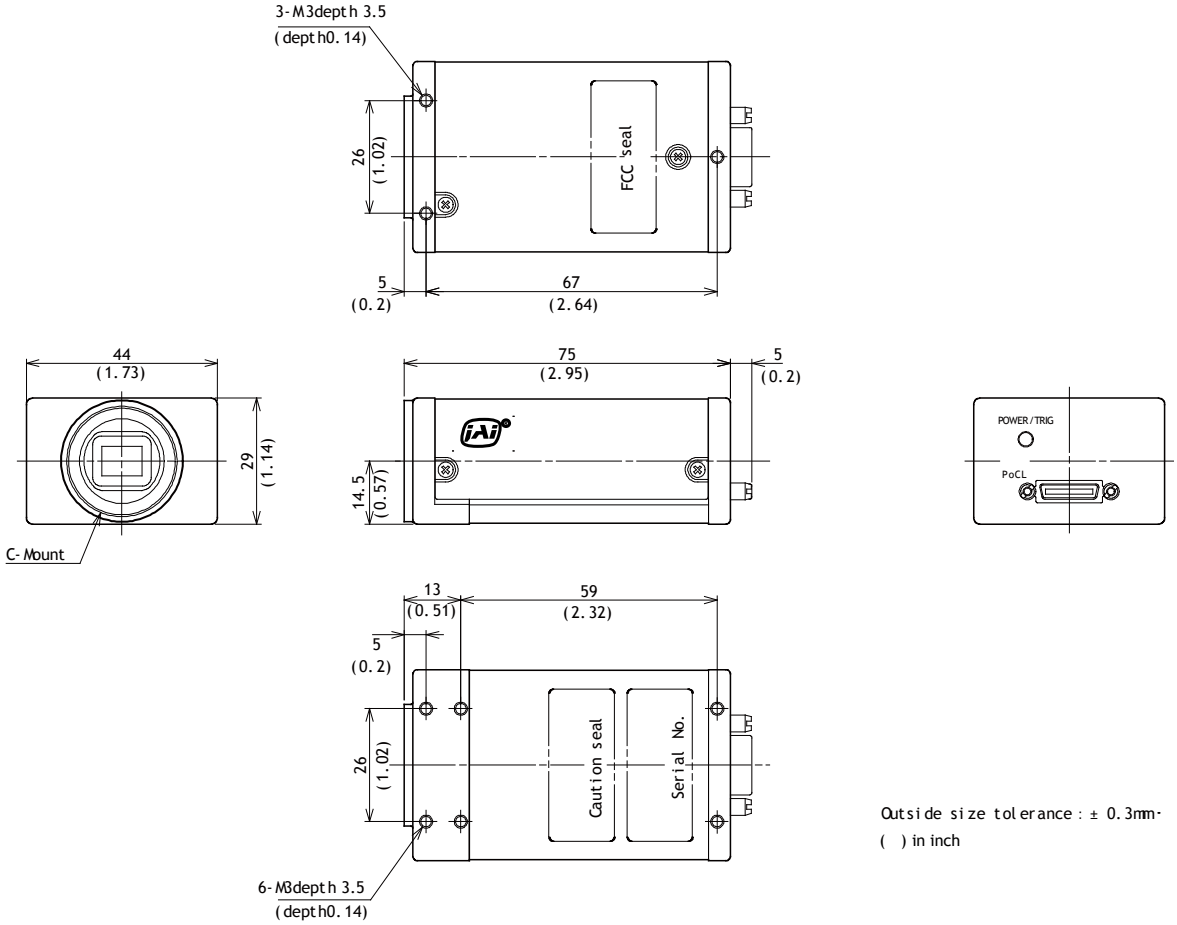


Fig.34 Outline for CM/CB-141PMCL

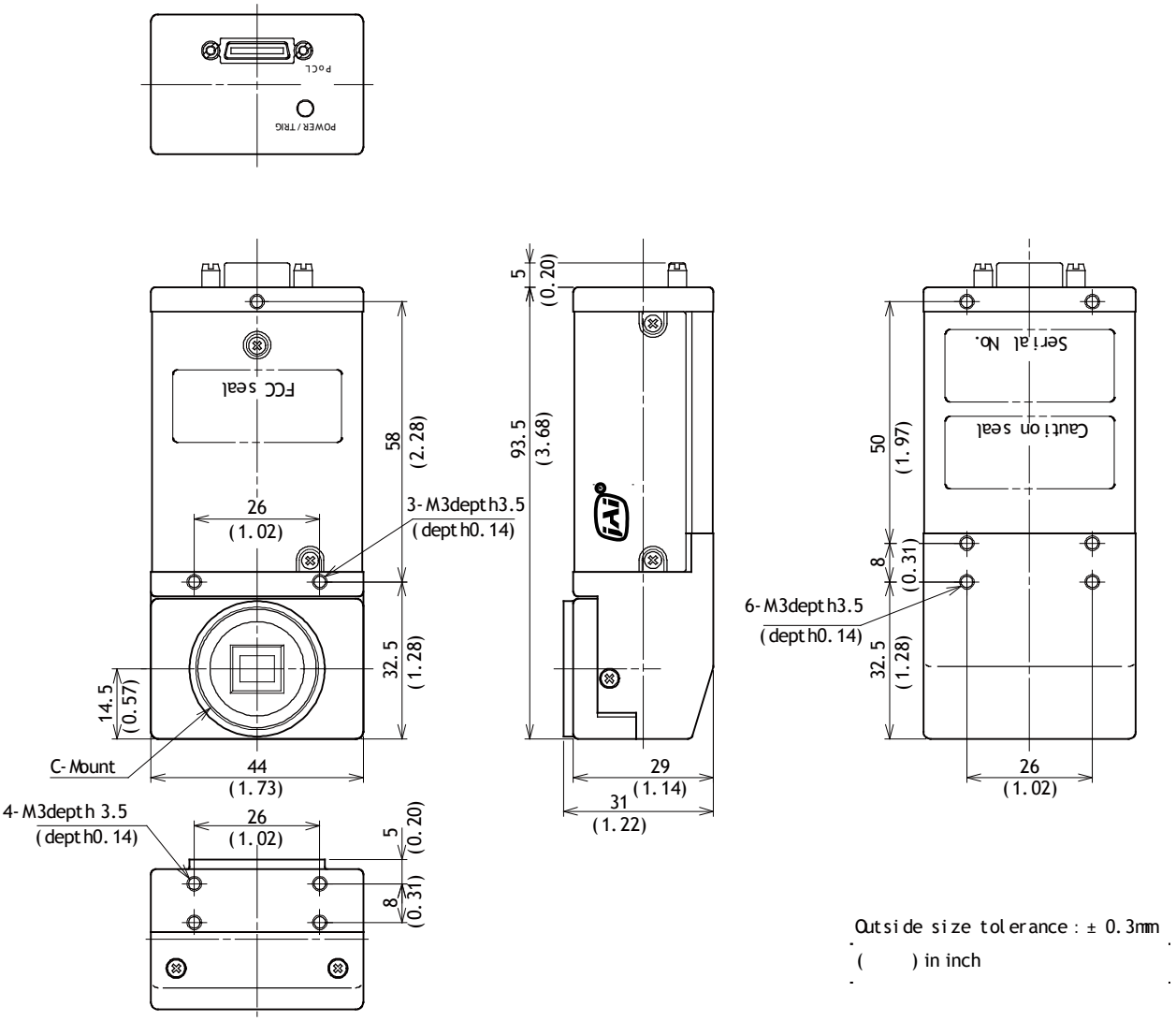


Fig.35 Outline for CM/CB-141PMCL-RA

10. Specifications

10.1 Spectral response

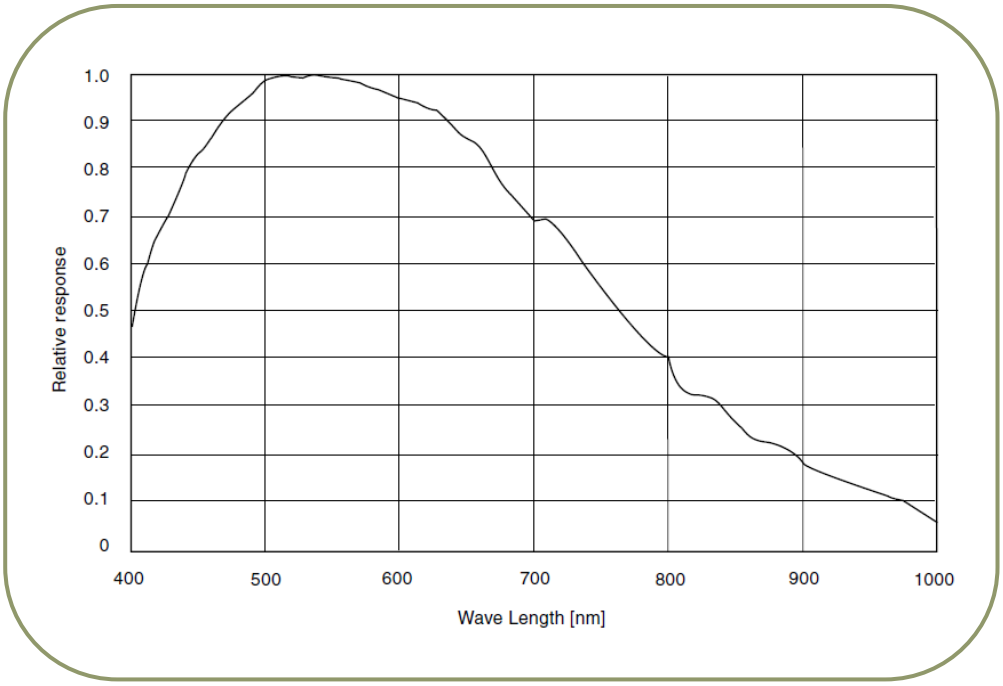


Fig.36 Spectral response for CM-141MCL/141MCL-RA

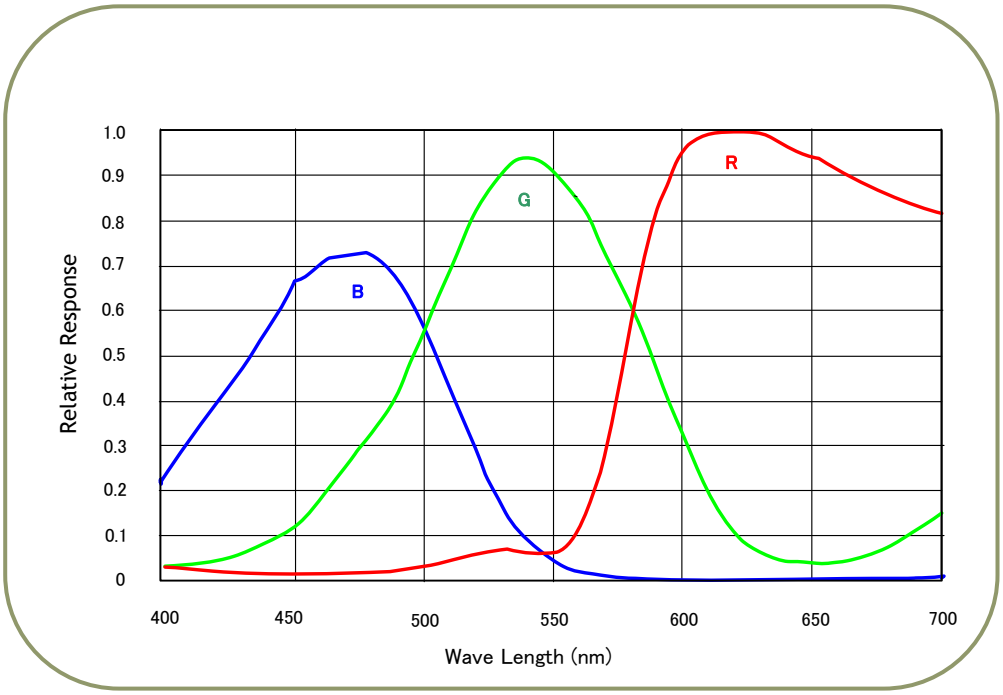


Fig.37 Spectral response for CB-141MCL/141MCL-RA

10.2. Specification table

Specifications	CM-141MCL/PMCL/-RA	CB-141MCL/PMCL/-RA
Scanning system	Progressive scan	
Frame rate full frame	30.12 frames/sec. Progressive (1052 lines/frame)	
Pixel clock	58 MHz	
Line frequency	31.693 kHz (1H = 31.551 μs) (1830 pixel clock/line)	
CCD sensor	2/3 inch Monochrome ICX285AL	2/3 inch Bayer Color ICX285AQ
Sensing area	8.98 (h) x 6.7 (v) mm 2/3 inch diagonal	
Cell size	6.45 (h) x 6.45 (v) μm	
Active pixels	1392 (h) x 1040 (v)	
Pixels in video output. Full Scan 2/3 partial Scan 1/2 partial Scan 1/4 partial Scan 1/8 partial Scan Variable Partial Scan Vertical Binning	 1392 (h) x 1040 (v) 30.12 fps. H = 31.693 kHz 1392(h) x 694 (v) 41.05 fps H= 31.693 kHz 1392 (h) x 520 (v) 50.06 fps. H = 31.693 kHz 1392(h) x 260 (v) 74.57 fps. H = 31.693 kHz 1392 (h) x 130 (v) 98.73 fps. H = 31.693 kHz Start line from 1 to 1024, height(lines) from 8 to 1032 1392 (h) x 520 (v) 50.18 fps. H = 26.447 kHz (CM-141MCL/PMCL/-RA only)) Note: Partial scan and Vertical Binning mode cannot be used at the same time	
Sensitivity on sensor (minimum)	0.03 Lux (Max. gain, Shutter OFF, 50% video)	0.2 Lux (Max. gain, Shutter OFF,50% Green, w/IR cut filter)
S/N ratio	More than 58 dB (0dB gain)	
Digital Video output	Camera Link 8 bit, 10 bit, 12 bit	Camera Link BAYER 8 bit, 10 bit, 12 bit
Iris video output. Analog	0.7 V p-p	
Gain	Manual : -6 to +24 dB (1 Step 0.0358 dB)	
Gamma	γ=1.0	
Synchronization	Internal X-tal	
Hardware Trigger modes	Edge Pre-Select , Pulse Width Control, RCT, Smearless EPS	
Smearless mode	Available for EPS (Async)	
Electronic Shutter Preset Shutter speed Programmable exposure Fine Exposure	 OFF(1/30) and 1/60 to 1/10,000 in 9 steps 2L(63μs) to 1052 L (33.19 ms) in 1L steps 1/15847 to 1/85149s (PE=2)(FE=0 to 2979)	
Lens Iris Control	Video control	
Control interface	Camera Link	
Indicators on rear panel	Power, trigger	
Operating temperature	-5°C to +50°C	
Humidity	20 – 90% non-condensing	
Storage temp/humidity	-25°C to +60°C/20% to 90 % non-condensing	
Vibration	10G (20Hz to 200Hz, XYZ)	
Shock	70G	
Regulatory	CE (EN61000-6-2 and EN61000-6-3), FCC part 15 class B, RoHS, WEEE	
Power	12V DC ± 10%. 5.1 w	
Lens mount	C-mount Rear protrusion on C-mount lens must be less than 10.0mm	
Flange back	17.526mm Tolerance 0 ~ -0.05mm	
Optical Low Pass Filter	Built in (Only for CB-141MCL/141MCL-RA)	

Specifications		CM-141MCL/PMCL/-RA	CB-141MCL/PMCL/-RA
Dimensions	CM/CB-141MCL/PMCL	44 x 29 x 75 mm (W x H x D) excluding protuberances	
	CM/CB-141MCL/PMCL-RA	44 x 29 x 93.5 mm (W x H x D) excluding protuberances	
Weight	CM/CB-141MCL/PMCL	130 g	
	CM/CB-141MCL/PMCL-RA	160 g	

In order to get specified performance, it is needed to have approx. 30 minutes pre-heating.

Above specifications are subject to change without notice

11. Appendix

11.1. Precautions

Personnel not trained in dealing with similar electronic devices should not service this camera.
The camera contains components sensitive to electrostatic discharge. The handling of these devices should follow the requirements of electrostatic sensitive components.
Do not attempt to disassemble this camera.
Do not expose this camera to rain or moisture.
Do not face this camera towards the sun, extreme bright light or light reflecting objects, including laser sources.
When this camera is not in use, put the supplied lens cap on the lens mount.
Handle this camera with the maximum care.
Operate this camera only from the type of power source indicated on the camera.
Remove power from the camera during any modification work, such as changes of jumper and switch settings.

11.2. Typical Sensor Characteristics

The following effects may be observed on the video monitor screen. They do not indicate any fault of the camera, but do associate with typical sensor characteristics.

V. Aliasing
When the camera captures stripes, straight lines or similar sharp patterns, jagged image on the monitor may appear.

Blemishes
All cameras are shipped without visible image sensor blemishes.
Over time some pixel defects can occur. This does not have a practical effect on the operation of the camera. These will show up as white spots (blemishes).
Exposure to cosmic rays can cause blemishes to appear on the image sensor. Please take care to avoid exposure to cosmic rays during transportation and storage. It is recommended using sea shipment instead of air transportation in order to limit the influence of cosmic rays on the camera.
Pixel defects/blemishes may also emerge due to prolonged operation at elevated ambient temperature, due to high gain setting or during long time exposure. It is therefore recommended to operate the camera within its specifications.

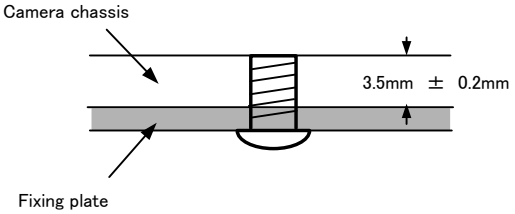
Patterned Noise
When the sensor captures a dark object at high temperature or is used for long time integration, fixed pattern noise may appear in the image.

11.3. Caution when mounting a lens on the camera

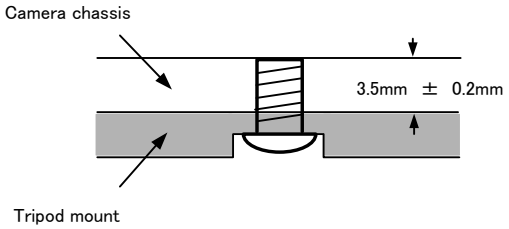
When mounting a lens on the camera dust particles in the air may settle on the surface of the lens or the image sensor of the camera. It is therefore important to keep the protective caps on the lens and on the camera until the lens is mounted. Point the lens mount of the camera downward to prevent dust particles from landing on the optical surfaces of the camera. This work should be done in a dust free environment. Do not touch any of the optical surfaces of the camera or the lens.

11.4. Caution when mounting the camera

When you mount the camera on your system, please make sure to use screws of the recommended length described in the following drawing. Longer screws may cause serious damage to the PCB inside the camera.



If you mount the tripod mounting plate, please use the provided screws.



11.5. Exportation

When exporting this product, please follow the export regulation of your own country.

11.6. References

1. This manual for CM-141MCL/141MCL-RA / CB-141MCL/141MCL-RA can be downloaded from www.jai.com
2. Datasheet for CM-141MCL/141MCL-RA / CB-141MCL/141MCL-RA can be downloaded from www.jai.com
3. Camera control software can be downloaded from www.jai.com

Index

A

Auto Iris Lens 17

B

Bayer mosaic filter 14
Blemishes 45

C

Camera Link 9, 11
CCD sensor 43, 46
CCD Sensor 19
continuous 13, 20, 21
Continuous operation 23

D

DIP switch 9

E

Edge Pre-select (EPS) 24
Edge pre-select(EPS) 13
Electronic Shutter 16
external trigger 10, 18

F

Fine Exposure 16

G

Gain 43
Gigabit Ethernet 8

H

Hirose 10, 25

L

Lens mount 43

P

partial scan 21
Partial scanning 21
Partial Scanning 14
Pixels in video output 43
PoCL 9
Preset Shutter 16, 43
Programmable Shutter 16
Pulse Width Control (PWC) 25
Pulse width control(PWC) 13

R

RCT 27
RS-232C 30

S

Smearless 28
Spectral response 42
Synchronization 43

T

Trigger input 17
Trigger mode 25, 27, 28
Trigger polarity 10

V

Vertical Binning 13, 22

X

XEEN 10

Change History

Month/Year	Revision	Changes
May 2009	1.0	New issue
Sept 2009	1.1	Change the depth in chasses for screws from 4mm to 3.3mm and add the caution on Appendix, 11.4
Feb 2010	1.2	Correct the wrong description (Chapter 5.1 #11 of 12pin connector is NC, not DC+12V in .)

User's Record

Camera type:	**CM-141MCL/141MCL-RA/141PMCL/141PMCL-RA** **CB-141MCL/141MCL-RA/141PMCL/141PMCL-RA**
Revision:	**……..**
Serial No.	**……..**
Firmware version.	**……..**

For camera revision history, please contact your local JAI distributor.

User's Mode Settings.

User's Modifications.

Company and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.
JAI A-S cannot be held responsible for any technical or typographical errors and reserves the right to make changes to products and documentation without prior notification.

Europe, Middle East & Africa	*Asia Pacific*	*Americas*
Phone +45 4457 8888 *Fax +45 4491 3252*	*Phone +81 45 440 0154* *Fax +81 45 440 0166*	*Phone (toll-free) +1 800 445 5444* *Phone +1 408 383 0300*

Visit our web site at www.jai.com

See the possibilities